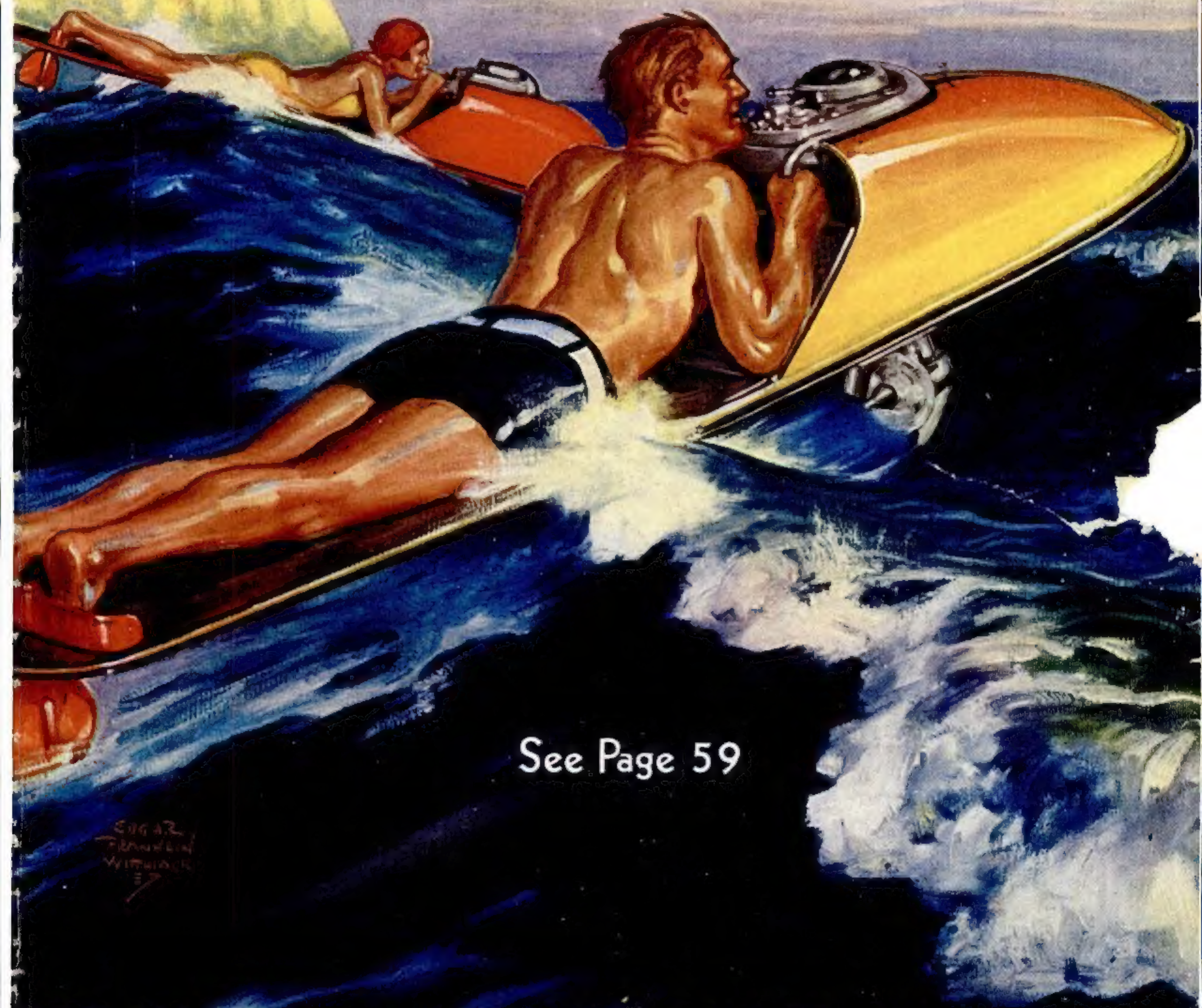


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AUGUST

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See Page 59

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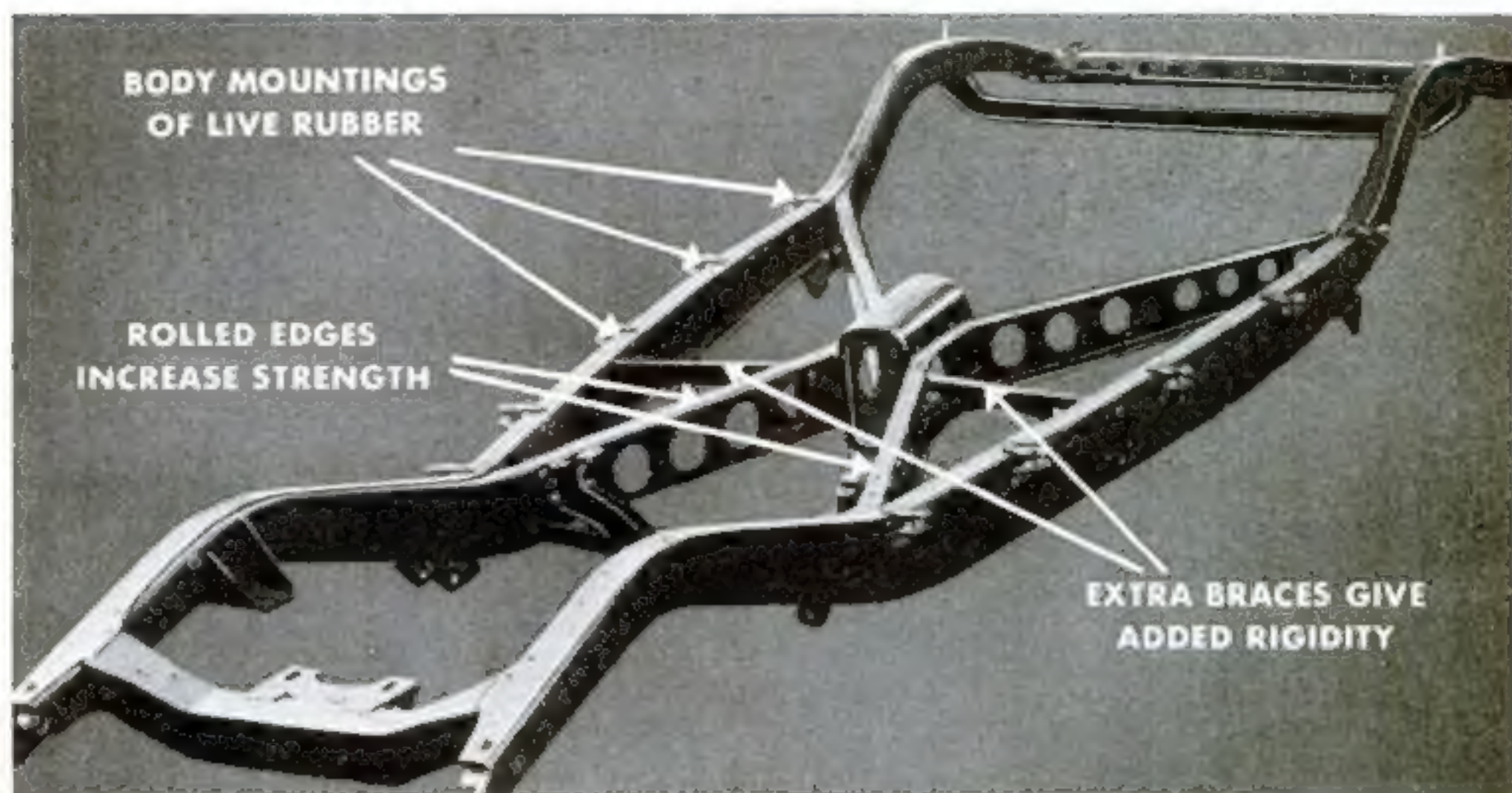
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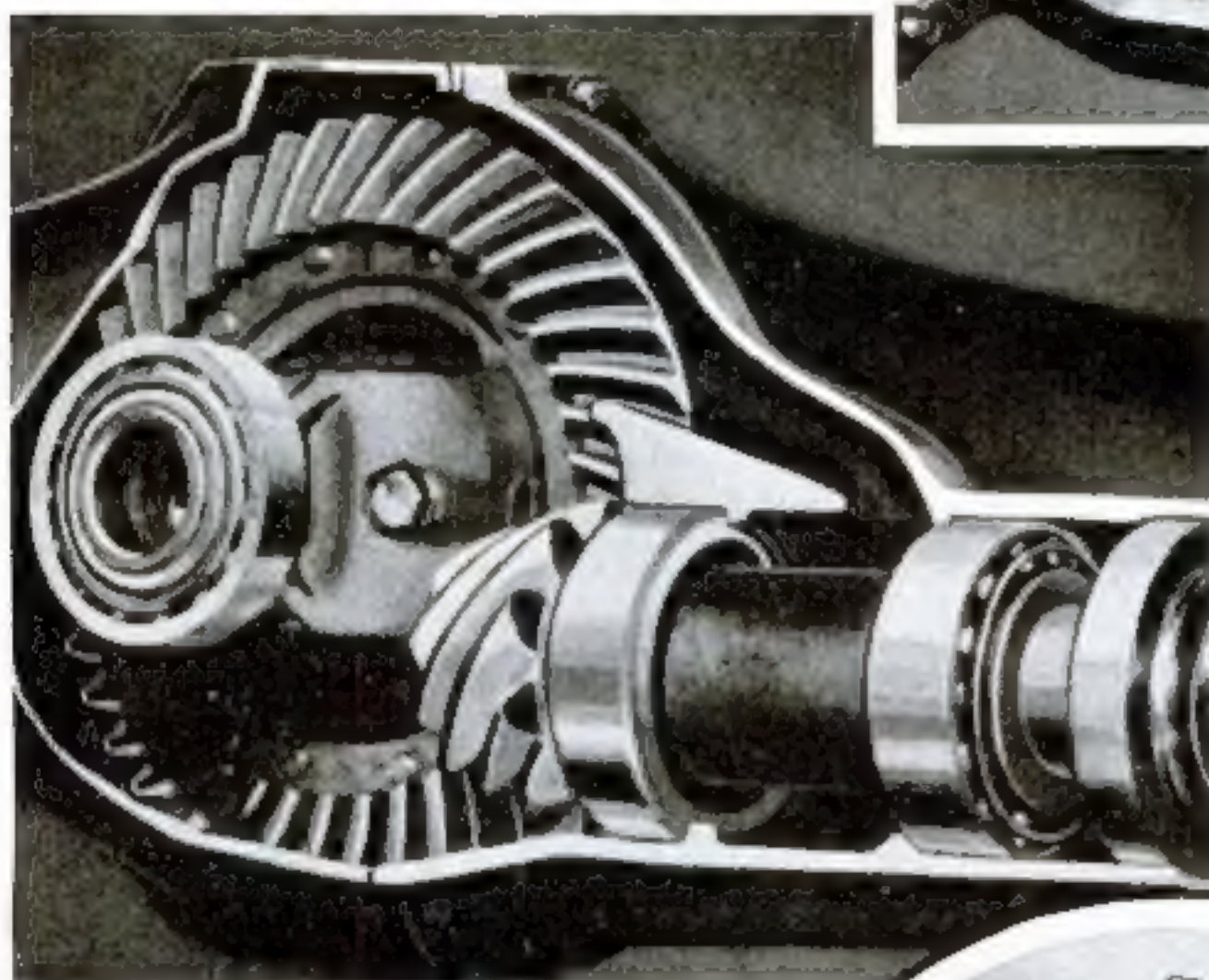
Things to Look for in Judging a Car's Stamina

HERE are some of Plymouth's engineering improvements. Others not pictured here, include Plymouth's *all-rustproofed* sheet metal...super-hard valve seat inserts...anodic-coated pistons.

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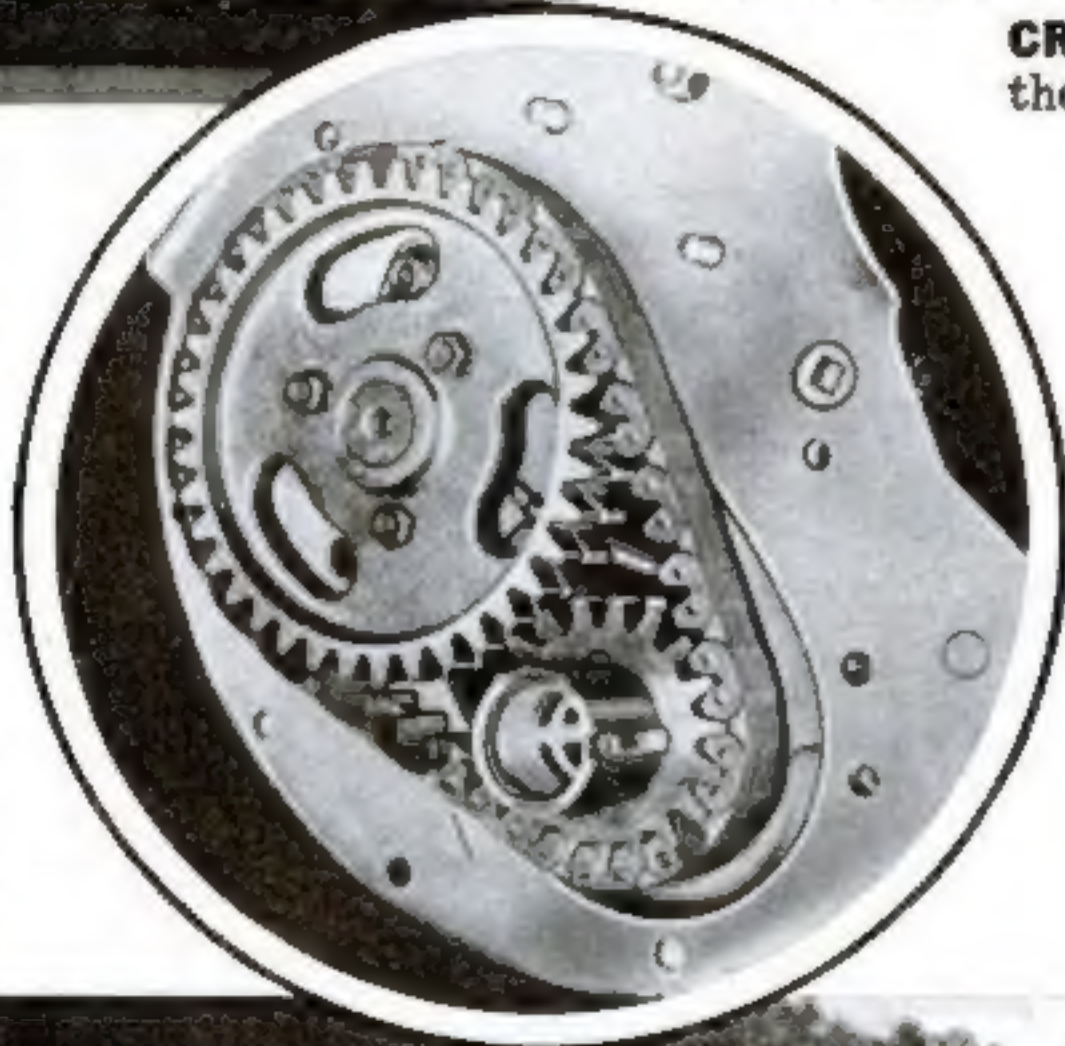
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HYPOID rear axle has a much longer life than the spiral bevel type...bigger and longer-lived gear teeth. It also lowers the propeller shaft...removing "hump" from rear compartment floor.



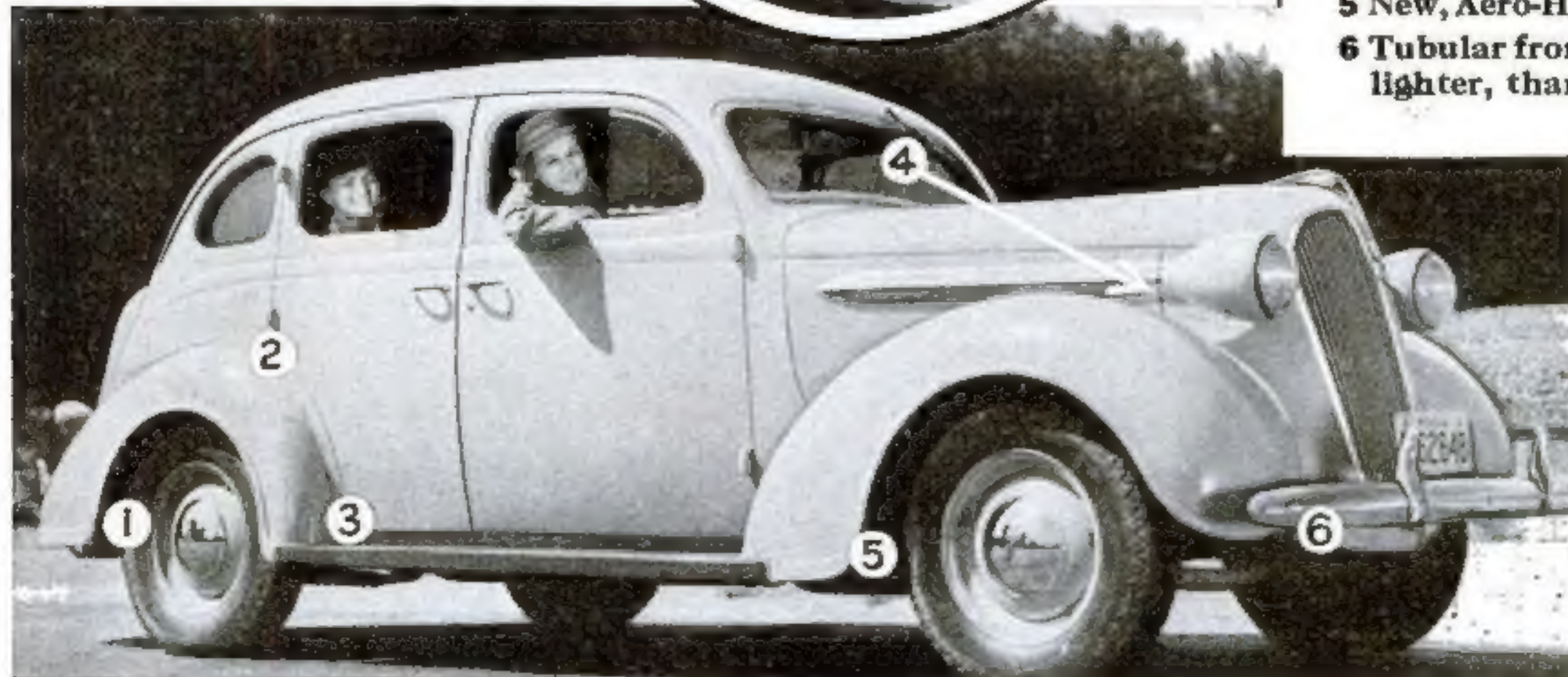
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Our Readers Say



How Many Miles on a Bushel of Oats?

HAVING been raised on a farm, I kind of like the odd tractor you showed in your July issue—the one that is driven with reins like a horse. It surely would seem a lot more natural to an old-fashioned farmer than one with a steering wheel. But why not have a microphone hooked up to the controls so that it would respond to "gee," "haw," and "whoa"?



Personally, I would like to see these tractors put on the market for use with buggies. Imagine taking your best girl out for a drive in the moonlight, wrapping the reins around the whipstock (you'd have to have one), and letting Dobbin find his own way back to the garage!—K.A.B., Atlanta, Ga.

The Siberian Article Didn't Leave Him Cold

THE marvels being performed by inventors and the commercial application that is made of them as the story of progress is unfolded from month to month in *POPULAR SCIENCE* always interest me. I could hardly believe the description you gave of the development of Siberia by the Soviet Government. I had always supposed that country to be a barren waste, nearly useless as far as man is concerned. I have heard that Russia is making and developing a great system of canals and hydroelectric power plants. I would be interested in seeing a description of them in "our" magazine.—H.B.S., Amherst, Colo.

This Problem Puts The "Try" in "Triangle"

HERE'S a problem that will give our puzzle fans something to figure out. I hope some of them get what I got—a headache! I am just mean enough to pass it along because it was wished on me by a well-meaning friend (!) to whom I confided that I enjoyed solving problems. Each of three men stands at one of the points of an equilateral triangle, whose sides are one mile long. One man can walk two miles an hour, the second, three miles, and the third, four miles an hour. They all start at the same instant, and walk toward a given point inside the triangle, all meeting at this point at the same time. Tell me, then, what is the location of the place where they meet?—F.L.M., Aurora, Ill.



He's Casting About For Angling Articles

I HAVE been taking your excellent magazine for nearly four years, and I think it's about time I put in my two-cents worth. How about having some articles on casting and fishing? I am sure they would be appreciated by a large number of your readers. I think that the reader who suggested an index had the right idea. I frequently have trouble looking up articles what were printed in past issues, and would appreciate a complete annual listing of *POPULAR SCIENCE* subjects.—R.C.P., Detroit, Mich.

Wouldn't Want to Make Test Tubes, Too?

LET me add my voice to the requests for more articles on organic chemistry. In addition to this, I would like to see some articles on constructing one's own laboratory apparatus, including a ring stand, Bunsen burner, laboratory balance, and other pieces of equipment. These would make it easier to perform the experiments described in the excellent chemistry series that appears in your magazine each month.—E.P., Ottawa, Ont., Canada.

YEAH, HOW ABOUT SOME GLASS BLOWING TOO?



Ways To Snap Yourself As Others See You

FRED DAVIS could have taken that picture of himself and the quintuplets, if he had wanted to, R.K. Aside from the crude but effective method that the cartoonist humorously suggested with your letter, there are at least three other ways of doing the trick. Many cameras have a "self-timer" built in. You just set this gadget, walk around in front of the camera while it's buzzing, and, click, there's your picture. If your camera hasn't got this feature, you can buy an attachment that will do the same trick. Another way to take a picture of oneself is to get an extra-long cable release—you can buy them as long as six feet. Professional cameras that have bulb-operated shutters can also be equipped with a long rubber hose. There is a third way of making a photograph like this, although I'm afraid it wouldn't work with five lively quins. Stop the lens down all the way, so it is necessary to make a long time exposure of at least two or three minutes. Set the shutter on "time," open it, then walk in front of the camera and sit perfectly still for the length of the exposure, then get up and close the shutter. I have used this method several times, and no one, not

even professional photographers, has been able to detect how it was done. Of course, it can't be done in strong light, because the camera would then pick up your image while you are walking to and from it. Perhaps some of our friends know other ways to "snap" ourselves as others see us.—M.B., Syracuse, N.Y.

How Far Away Is Your Image in the Mirror?

HERE is a practical problem that came to me one morning while I was shaving. Suppose you are looking at yourself in a mirror that is one foot away from your eyes. Do you actually see the image of yourself one foot away, or do you see yourself at a distance of two feet, twice as far as you are from the mirror? That problem has puzzled me for sometime.—M.M., Flint, Mich.

HOW YA GONNA MEASURE IT?



Model-Railroad Fan Takes Us for a Ride

CONGRATULATIONS! I see that in the June issue you have given a whole page to model railroading. I like your magazine and could be satisfied with it the way it is, but I want, and wish you would give two full pages of model railroading every month as you now do for microscopy and chemistry.—W.B., St. Louis, Mo.

Where Does Rubber Go When Tires Wear Out?

A NEW use for automobile tires was suggested by I.K.G., of Biglerville, Pa., and it brings up a question that has been bothering me for some time. I bought a new tire for my car a while back, and when I compared it with the old one, I was astonished at the difference in the amount of rubber on the old one and the new. A layer of rubber about half an inch thick and four inches wide had worn off the old tire in the many months that I had used it. I began thinking of this amount of rubber multiplied by the number of tires that are worn out every year, and the total number of tons must be staggering. What I want to know is: what happens to all the rubber? I realize that some of it sticks to, and discolors, concrete pave- (Continued on page 5)

THAT WORRIES ME A LOT!



Our Readers Say

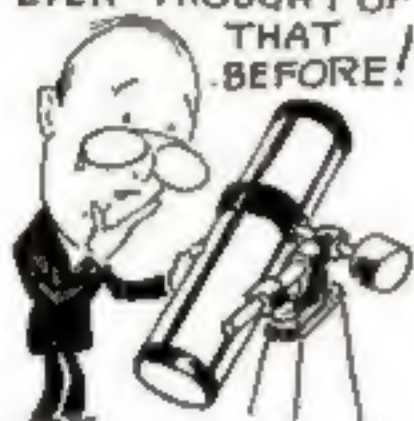
(Continued from page 4)

ment, but that could only account for a very small part of the annual consumption. It might be interesting to make observations on pavements that are very heavily traveled, to learn whether the rubber goes off in dust, oxidizes, or is dissipated in some other way.—R.E.P., Rutland, Vt.

Metal Would Make Cheaper Telescope Mirrors

AFTER reading a great deal about large glass telescope mirrors, and the enormous cost and trouble involved in casting them, it occurred to me to question why glass is used at all. It should be possible to use cast or pressed metal instead of the fragile material now employed. Of course, this idea may be entirely impractical, but if it works, it should be possible to build telescopes ten to 100 times the size of those now in use, and more efficient as well, because a glass mirror cannot be focused accurately at any definite point.—J.H., Chicago, Ill.

IMAGINE, NO ONE
EVER THOUGHT OF
THAT
BEFORE!



Right-and-Left Socks Are Not so Far-Fetched

B.E.P., of New London, Conn., suggests that socks be made in pairs—right and left-hand stockings being shaped to conform to the corresponding feet. Perhaps he would be interested in knowing that twenty-five years ago, here in Lowell, I was able to buy socks of this description.—Mrs. I.B.C., Lowell, Mass.

Wanted: Car Radio That Is Both Cheap and Practical

I HAVE enjoyed and been benefited by each issue of your magazine for many years, and think it is the most interesting publication on the news stands. I have noticed that many of your readers request articles on their favorite subjects, and are rewarded by seeing what they wanted in a later issue. Now I am going to request plans for an inexpensive but very practical car radio. In order to buy a good set for an automobile, you have to pay quite a stiff price, so I thought I'd turn to POPULAR SCIENCE for help in supplying such plans.—W.H., Floral Park, N.Y.

ME TOO,
DITTO,
CHECK!



A Historian's Boost for P. S. M.

I AGREE with K.B.F., Canal Fulton, Ohio, that some of your readers make ill-considered requests, such as the one from the mathematician (?) who wanted a course in calculus. It might enlighten some of these captious critics of your policies to learn the opinion of one who was well (Continued on page 6)



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See the newest release of the "Popular Science" series. If your own neighborhood theatre hasn't booked it yet, ask the manager to do so. It's something you and the whole family will want to see.

Produced in Cinecolor by Carlisle & Fairbanks with the co-operation of the editors of Popular Science Monthly

A Paramount Picture

Our Readers Say

(Continued from page 5)

qualified to judge. In 1890, John Fiske, the historian, referring to the crowning achievement of Edward L. Youmans's life, the establishment of POPULAR SCIENCE MONTHLY, said, "It was not the aim of the magazine to give an account of every theory expounded, every fact observed, every discovery made . . . The mind of the people is not educated by dumping a great unshapely mass of facts into it. It needs to be stimulated rather than crammed . . . The POPULAR SCIENCE MONTHLY has now been with us eighteen years; its character has always been of the highest, and it must have exerted an excellent influence not only as a diffuser of valuable knowledge, but in training its readers to scientific habits of thought . . ." Fiske would express this same opinion today.—S.A.M., Sykesville, Md.

No Movie Fan Stories Wanted, He Says

IT SEEMS to me that T.F.'s recent suggestion regarding an article on movie stars was rather silly. There are dozens of movie magazines on the corner news stands, but only one POPULAR SCIENCE. "Our" magazine is a science and handicraft publication, so why should it be messed up with a lot of stories about glamorous stars and the like? I am very much interested in miniature photography, and have a little camera that cost me about \$1.25. I use about a roll of film a week. One of the things I would like to see is an article describing a good, safe light for a photographic dark room.—J.A., Toronto, Ont., Canada.

EASY, USE "PAN" AND YOU DON'T NEED A LIGHT!



This Stargazer Wants Plans for a Reflecting Telescope

I AM sure that an article on the construction of reflecting telescopes would prove to be a practical subject, interesting to a great many of your readers.—D.A.W., Barstow, Calif.

Start Making Your Index With This Very Issue

I CAN'T say that I have much sympathy for those readers who have been hollering for an index. If they weren't so lazy or unimaginative, they'd make their own. Here's how I do it: Every month, when I get my copy of the magazine and have finished reading it, I take a handful of three-by-five inch index cards and go through the book from cover to cover, making out a card for each article that interests me. I have a shallow drawer in my desk, which I partitioned off into five-inch-wide sections, and in these I file the cards alphabetically. Of course, many articles, especially those that relate directly to my own favorite hobbies, are indexed under three or four heads, with as many different cards referring to them. When I see an interesting article in a newspaper or other magazine, I clip it out and paste it in a scrapbook with numbered pages, and these articles, too, are listed in (Continued on page 7)

"BLOW SOME HIS WAY, OSCAR!..



..and then switch
to the brand of
grand aroma"



IF ever there was a use for that foul-smelling pipe of yours—this is it! Blow some at the bull, and spare your lady-love! Then reform. Run a couple of cleaners through that soupy pipe-stem and load the bowl with fine-flavored Sir Walter Raleigh. Blended of choice Kentucky Burleys, Sir Walter is a smoke worth knowing. It's fresh, because it's packed in heavy gold foil. And it's only 15¢ for a two-ounce tin.



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of
YOUR PIPE

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NBC Blue Network, Fridays 10:00 P. M., E. D. S. T.

Our Readers Say

(Continued from page 6)

the card index. Whenever I want to look anything up, I can do so instantly. The big advantage of the system is that it's always up to the minute, and that it isn't necessary to look in each of several annual or semiannual indexes to find what I want. It might seem like a lot of trouble to keep the thing up-to-date, but actually, it takes me only about an hour every month; a small price to pay for all the information it places at my disposal.—F.S.C., Harrisburg, Pa.

Cars Get Ahead With Push—Not Pull

IN REGARD to C.E.P., Jr.'s letter concerning the misuse of the term, "Ball bearing," I would like to come forward and add another word to his crusade. Every time you read about a car's getting almost stuck in the mud or in a hole of some sort, it is said that the car "pulled out" of the hole. Now, ninety-nine percent of the cars on the road today have their drive wheels in the rear, and it seems to me that they are pushing, instead of pulling the car. Of course, in reverse gear, the wheels would be pulling.—R.S.J., Dexter, Iowa.

SAY IT YOUR WAY,
BUT GET ME OUT!



What's the Matter With "Five Weeks in a Trailer"?

WHAT has happened to all the personal-experience stories you used to publish? True, I like to read about volcanoes, surfboard riding, engine builders, and plant wizards, but I'd get a bigger kick if you'd give us a few stories like the "I Learn To Fly" yarns you used to spin five or six years ago. Why not send one of your adventurous writers to the Navy diving school and give us all the exciting details in an article entitled, "I Try My Hand At Deep-Sea Diving"? Good true adventure stories are enjoyed by almost anyone, and when there's a little science mixed in with them they're tops. How about it?—H.S., Little Rock, Ark.

And the Rabbit Died A Martyr to Geometry

REGARDLESS of our sympathies in the matter of S.A.M.'s dog-and-rabbit problem, cold figures show that the unfortunate rabbit will be caught by the hound exactly fifty feet short of his goal. If the bunny, reputedly an expert at multiplication, had sharpened his wits by solving the stickers in POPULAR SCIENCE, he would have realized in advance the futility of fleeing, thereby conserving his energy. The dog also would have benefited, for it is well known that a leisurely walk before meals is much better than strenuous exercise. But the bunny's end was inevitable.—L.B., Los Angeles, Calif.

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CONTEST RULES

Only letters from bonafide home study school students will be considered and these must contain the name of the school and the name of the company, or companies, for whom you have worked since graduation. (Names, however, will be deleted from the letters when published.) We also want to know the kind of course you took and the type of position you have held. Your own identity will be kept anonymous, if desired.

We are interested in facts, not literary ability, but please write clearly, completely, and keep your letters within 750 words. We are not looking for "get-rich-quick" stories or freak adventures, and authors must be prepared to substantiate the truth of the statements. Manuscripts submitted and printed become the property of this magazine, and we are not responsible for the return of rejected stories unless sufficient postage is provided for this purpose. Address your contribution to Success Story, 353 Fourth Avenue, New York, N. Y.

HOME STUDY "ONLY WAY TO GO HIGHER"

I spent a year at A. & M. College of Texas after my graduation from high school, but for various reasons I had to discontinue the course and a little later found employment with the Power & Light Company.

My work with the utility consisted chiefly of ground labor, so after a few months I realized that the only way to get ahead was to train myself by home study along with what practical experience I could acquire.

The next move was to enroll with the School, and it was not long before I realized that as I studied and worked, the coordination of the two made each a lot easier. I also found that I was taking more and more interest in my work and doing it more efficiently.

None of my employers knew about the home study course but before any great amount of time had passed they began putting me on different and more difficult work, which I am pleased to say I handled pretty thoroughly.

I weathered the depression in good

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Secrets of Success

style and have been given salary boosts right along. My present position is that of district service man and I have not found many jobs that were hard to handle. Without handing myself any bouquets, I believe I am depended upon as much as anyone in my district.

This is just the beginning. I intend to train myself further and go higher, and correspondence courses are my only way to that goal.

—E. C. R., Lampasas, Texas.

"HAVE GIVEN MY BOYS A MARK TO SHOOT AT"

As a youngster, I always enjoyed drawing pictures, and when in later years I became the head of a family and found that the budget had a great way of running beyond my income, I started casting about for some way to supplement it.

Still retaining my liking for drawing cartoons, I thought that perhaps this might be the way out of my difficulty if I could discover some method for developing my talent.

I finally decided to take a course in cartooning with the _____ School. It cost \$25 but I made more than enough to pay for the course long before I had even finished it. Right here let me say—particularly to those who have put in long weeks and months at home study—that it requires an incentive and grim determination to carry on to the cross-roads of success and failure.

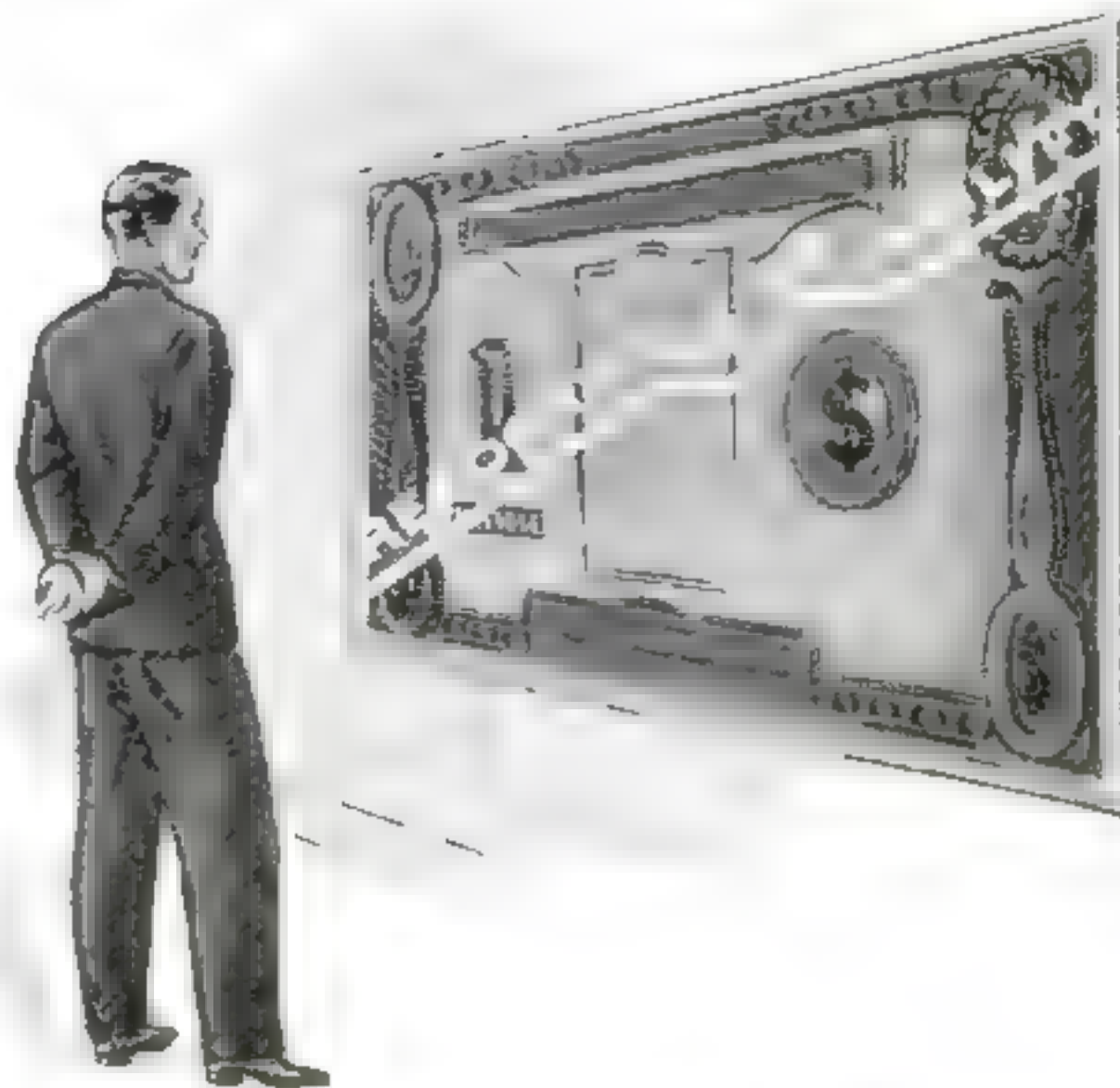
During the time I was taking this course, the character of my work changed so that an increase in hours kept me away from home until 12 o'clock midnight each night. Yet upon arriving home, I would study for at least an hour or two before retiring.

I was employed by the _____ Manufacturing Company, which, fortunately for me, published a plant magazine for the benefit of its employees. Besides being distributed among those who worked for the company, this magazine was also sent to customers all over the United States and in foreign countries, some thirteen or fourteen thousand copies being printed every month.

I saw an opportunity here and began handing in cartoons from time to time of different employees, associating them with some happening in their daily life at the plant. This had an immediate appeal not only to the employees but to company officials, the result being that I was soon getting paid for the drawings in addition to my regular salary.

This home study effort of mine has done two things. It has not only enabled me to provide a better living for my family and put three boys through high school and business college, but it has also set an example for the children. I may never make the front page, but I have given my boys a mark to shoot at, and that I think is most important.

—W. R. V., Decatur, Ill.



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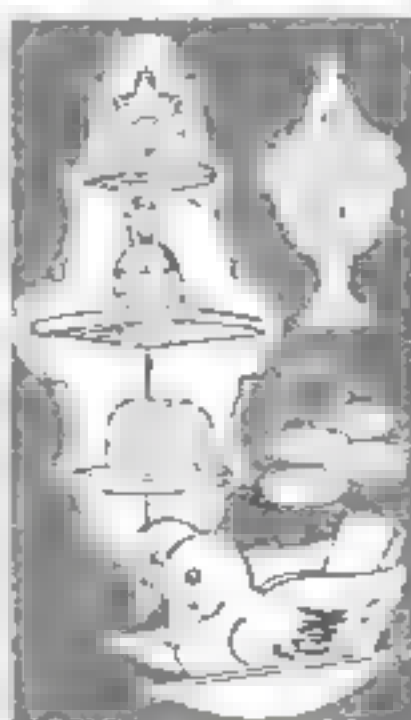
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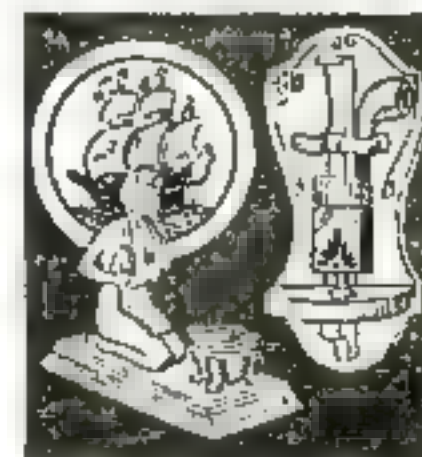
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Secrets of Success "LEADS TO GREATER INCOME CAPACITY"

Training as a stenographer, faithful work and fortunate circumstances eventually placed me in a well-paid and pleasant secretarial position in foreign service of the United States Government for a period of several years.

After returning to continental United States, I felt very much out of touch with business conditions, and quite unequipped to venture into anything successfully, other than purely clerical work. While making up my mind what I wanted to do, I once more became a stenographer, and a little later a secretary and court reporter. My ambition was to get into business, preferably selling of some kind.

In 1927, I left stenographic work and obtained a part-time contract as life insurance salesman. Having a goal of becoming either a general agent or of attaining some similar office, I lost little time in enrolling in a correspondence course. In due time, a diploma was received in the following salesmanship and insurance subjects: Selling as a Business Force; Mental Qualities Needed for Salesmanship; Development of the Mental Qualities; Health and Appearance; Study of the Customer; Study of the Commodity; Successful Reasoning; Making the Sale; Selling Life Insurance. The next year I signed a contract with another life insurance company, and eventually was promoted to District Manager.

Not satisfied with my lack of further organized study, in 1934 I had passed examination on two of five parts of the work required for Chartered Life Underwriter degree.

The correspondence study work was extremely helpful to me; I will cite two or three instances of definite results that might reasonably be attributed to it. (1) In competition with about three hundred agents employed by the Company, my name was included in the list of only ten persons who met their quota in full during the year 1929. (2) In 1933, for the month of March, I headed the list of all agents of the company in the amount of insurance applications written for that month. (3) During a contest lasting several weeks, I was awarded about twenty per cent of the five dollar prizes for essays submitted on insurance topics, although the contest was open to all agents of the company.

About two years ago, my health failed. I do not plan to return to aggressive life insurance selling. My experience having demonstrated to my satisfaction the value of correspondence courses, I am now seriously considering enrollment in some other subject—possibly photography, possibly law.

Certainly correspondence school study is a very practical way for adults to continue their education and will lead to greater income capacity when courses are properly chosen.

—W. H. B., Ruidoso, N. M.

We Glow in the Dark, New Tests Reveal

ALL human beings glow in the dark. You may never have noticed it, but that is simply because the strange luminous display lasts only a few seconds after exposure to sunlight or other illumination, according to two Stanford University, Calif., experimenters.

As long ago as the eighteenth century, an observer named Becchari reported, "If a person shut up in a dark room puts one of his hands out into the sun's light for a short time and then retracts it, he will be able to see the hand distinctly and not the other." Apparently, no one investigated this curious phenomenon further until 1933, when a Japanese research worker, S. Hoshijima, found that human bones, nails, cartilage, and teeth "phosphoresced," or glowed, after exposure to light, just as the chemical materials in phosphorescent types of luminous paint have long been known to do.

Now A. C. Giese and P. A. Leighton of Stanford University have found that invisible ultra-violet rays in sunlight and artificial light produce this human phosphorescence most effectively. After exposure for ten seconds to the light of a lamp containing mercury and argon vapors, the palm and back of the human hand glow for from two to four seconds, and the fingernails for ten seconds or more. Teeth phosphoresce for a still longer time. Other phosphorescent materials included wood, leaves, several kinds of flowers, and bean seeds.

Electric Currents Keep People Asleep

ELECTRICITY may be used as a cure for sleeplessness, as well as a substitute for drugs in producing local anesthesia, it is indicated in reports of research studies being carried on by Prof. G. Kalendarov, Russian biologist. The method is an extension of the system, known to scientists for several years, of applying certain kinds of electric current to living nerves to deaden them against pain. To determine whether electricity could produce complete and harmless anesthesia, or sleep, Professor Kalendarov first experimented with frogs. An electrode was connected to the frog's head, and another to the base of its spinal column. When the current was switched on, the frog fell asleep immediately, waking, apparently unharmed, only when the electricity was turned off. After extensive tests on other animals, the professor finally tried the experiment on himself. Awakening promptly after the current flow ceased, he declared that he had felt only a slight discomfort before losing consciousness. No bad after-effects developed, and "electric sleep" is now being carefully tested in Russian hospitals as a treatment in cases involving insomnia and for patients who would benefit from a long and drugless sleep after a major surgical operation.

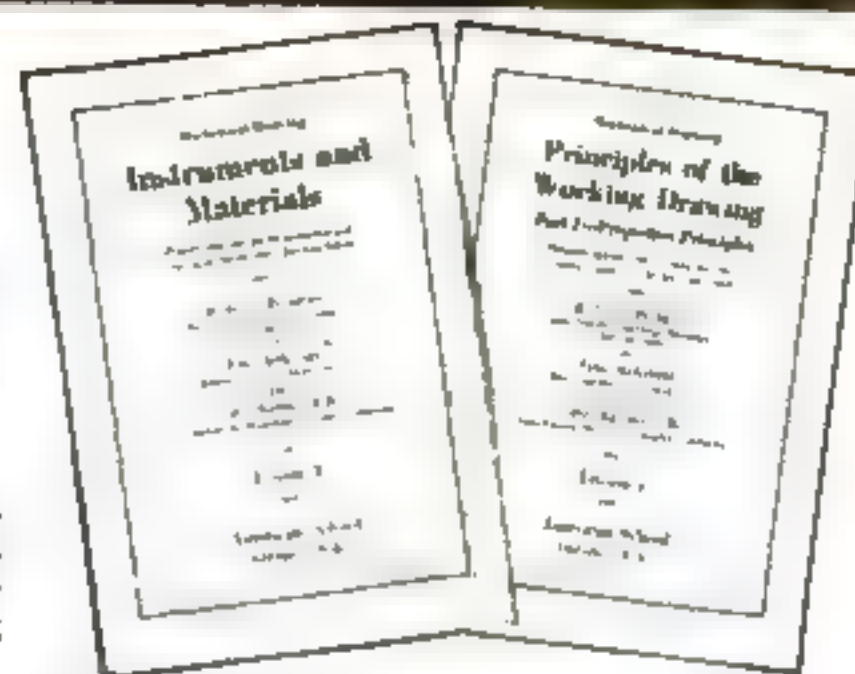
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New Ideas for HOME OWNERS



Combination Tool Is Screw Driver and Socket Wrench

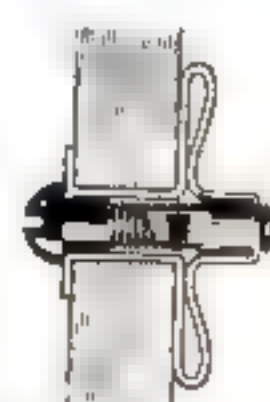
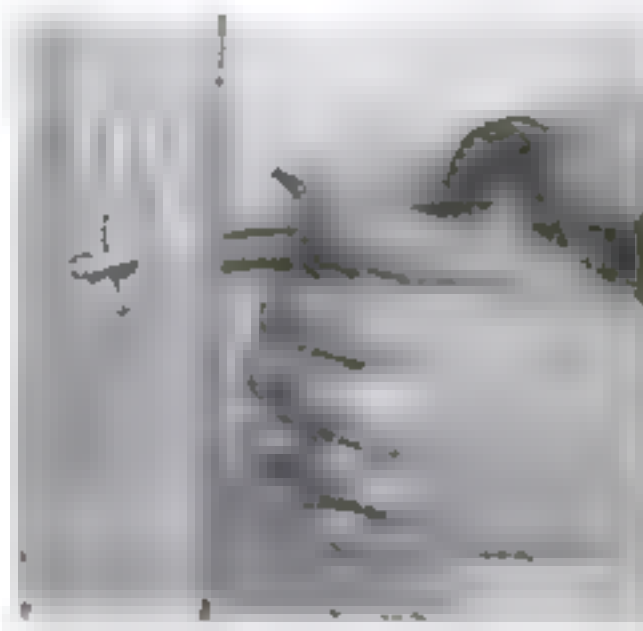
The interchange-
able tips, and,
right, the new
tool as a wrench



DESIGNED for use either as a screw driver or a socket wrench, the combination tool shown at the left is a handy unit for the home mechanic. Available in five and seven inch lengths, it is provided with a sturdy molded-plastic handle, and any one of a wide assortment of screw-driver blades and nut sockets can be quickly and easily installed in its hollow shank. To change from one to the other, the tip is simply pulled out and another inserted. Heavily insulated, the tool is shockproof, and is particularly valuable for electrical work. Rugged construction enables it to withstand hard twisting and dropping on concrete floors.

New Wall Toggle Bolt Is Self-Locking

AVAILABLE in various lengths and sizes, a new self-locking wall bolt provides a firm fastening from which the attached fixture can be removed at any time, leaving a permanent threaded anchor. To install it, the toggle is fitted to a special tool and inserted in the hole drilled in the wall. Turning a cupped wheel expands the anchor on the inside of the plaster or wall board, clamping it securely in place. The tool then can be removed and the fixture attached by screwing the mounting bolt into the threaded anchor, making possible a more secure installation.



To install the
anchor in wall,
as at left, the
toggle bolt is
fitted to the
hand tool above

Turning a wheel compresses
metal fingers to clamp anchor
securely in place behind wall

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Reflector Inside Lamp Eliminates Shadows

WITH an aluminum reflector attachment that clamps to the shade of a hanging lamp, home-workshop fans can spotlight shaded surfaces on machines or workbenches. Although not interfering appreciably with the lamp as a general overhead lighting unit, the adjustable accessory is handy for eliminating shadows caused by overhanging sections or obstructions on work.

Questions FROM HOME OWNERS

Q.—BECAUSE our attic becomes unbearably hot during the summer months, I plan to install insulating board. Is it better to apply this to the underside of the roof rafters, or beneath the attic floor?—C.R., Springfield, Ohio.

A.—THE PLACE to cover with insulating board depends on whether you use the attic space for living or sleeping purposes. If the space is often used, nail the insulation to the roof rafters or against the roof boards between the rafters. In case the attic serves primarily for storage, however, you would do better to (Continued on page 14)



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**Questions from
Home Owners**

(Continued from page 13)

apply the boards under the attic floor, either on top or between the joists. It is also advisable to have some sort of adjustable vent in the attic to allow for the free circulation of air.

Ink Stains on Rugs or Carpets

N.N.R., SYRACUSE, N.Y. Fresh ink spots on rugs or carpets can be effectively removed by spreading a thick layer of corn meal over the stain. As the ink is soaked up by the meal, remove the latter and replace with a fresh supply. Any traces of ink that remain can be eradicated by wiping the spot with a sponge dipped in skimmed milk.

Saving Left-Over Paint

E.B., GREAT BARRINGTON, MASS. Left-over paint or enamel can be effectively sealed in an opened can by pushing the friction top firmly into place, tapping its edges with a hammer, and then storing the can upside down. The paint will then seal the crack and prevent air from entering to form a film or scum on the contents.

Lubricant for Windows

Q.—What is a good lubricant to apply to windows and to sliding screens that tend to stick in damp weather?—L.R.C., Galesburg, Ill.

A.—Ordinary soap usually is a satisfactory lubricant for this purpose. Cut a slice from a bar and rub it along the inner rails of the window frame, or to the special strips which support the sliding screens.

Coffee Grounds in Sink Drain

V.A.D., PEORIA, ILL. Pouring coffee grounds in the sink generally will not clog the drain. If anything, the grounds will tend to scour out the pipes and keep them clear. Grease is the worst enemy of drain pipes, and should be removed with one of the several good chemical cleaners on the market.

Care of Piano Keys

C.B.A., OAKLAND, CALIF. Piano keys become yellow more quickly if they are constantly covered when not in use. Exposure to the daylight will help to keep the keyboard from developing unsightly age stains.

Boiling Toughens China

C.D.L., GRAND RAPIDS, MICH. A simple boiling process will toughen china or glass so that it will resist cracking when in contact with hot water. Place the article in a pan of cold water, heat slowly, and boil for about four hours. Allow it to stand in the pan until cool.

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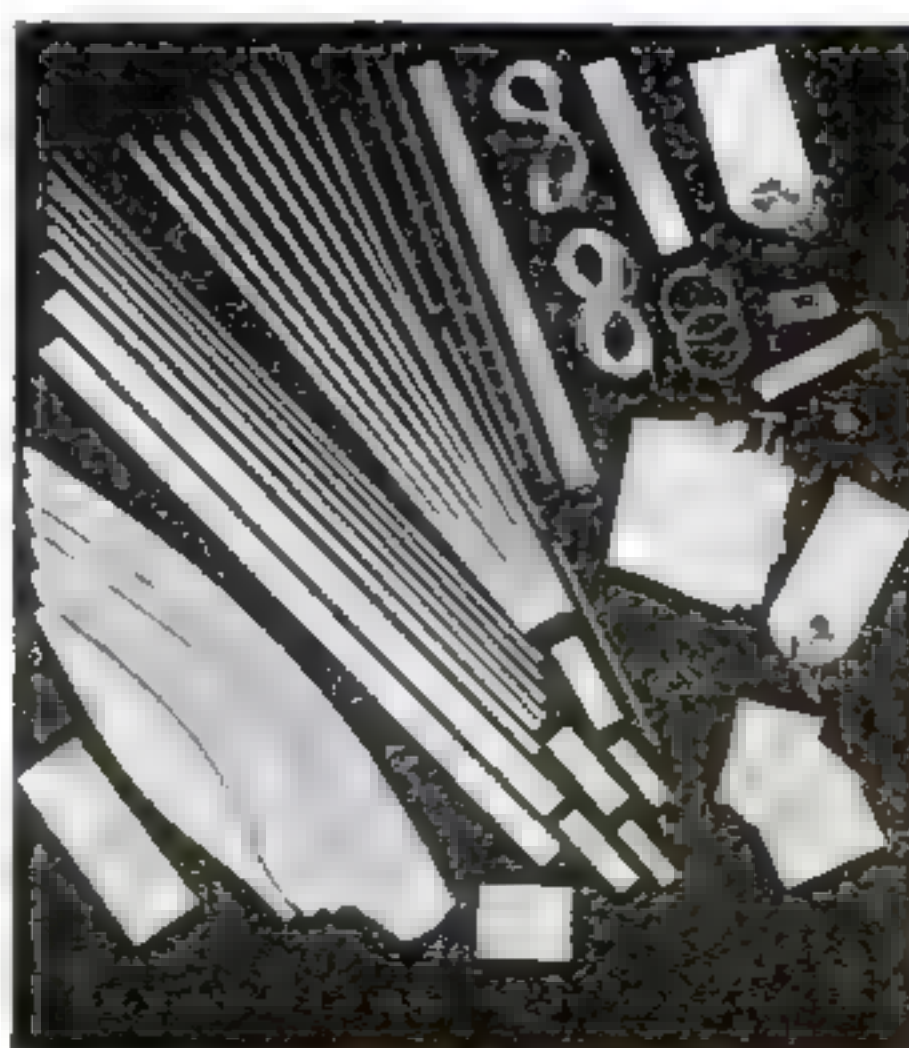
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Two New Kits FOR MAKING SHIP MODELS

TO ASSIST you in making ship models, we have prepared a variety of construction kits which simplify the work and save much time. This month two new kits have been added. One is for the *Blue Nose*, pictured above, which thousands of readers have already built from the blueprints alone, and the other is for the *President Lincoln* of the Dollar Line, a sketch of which appears on the next page.

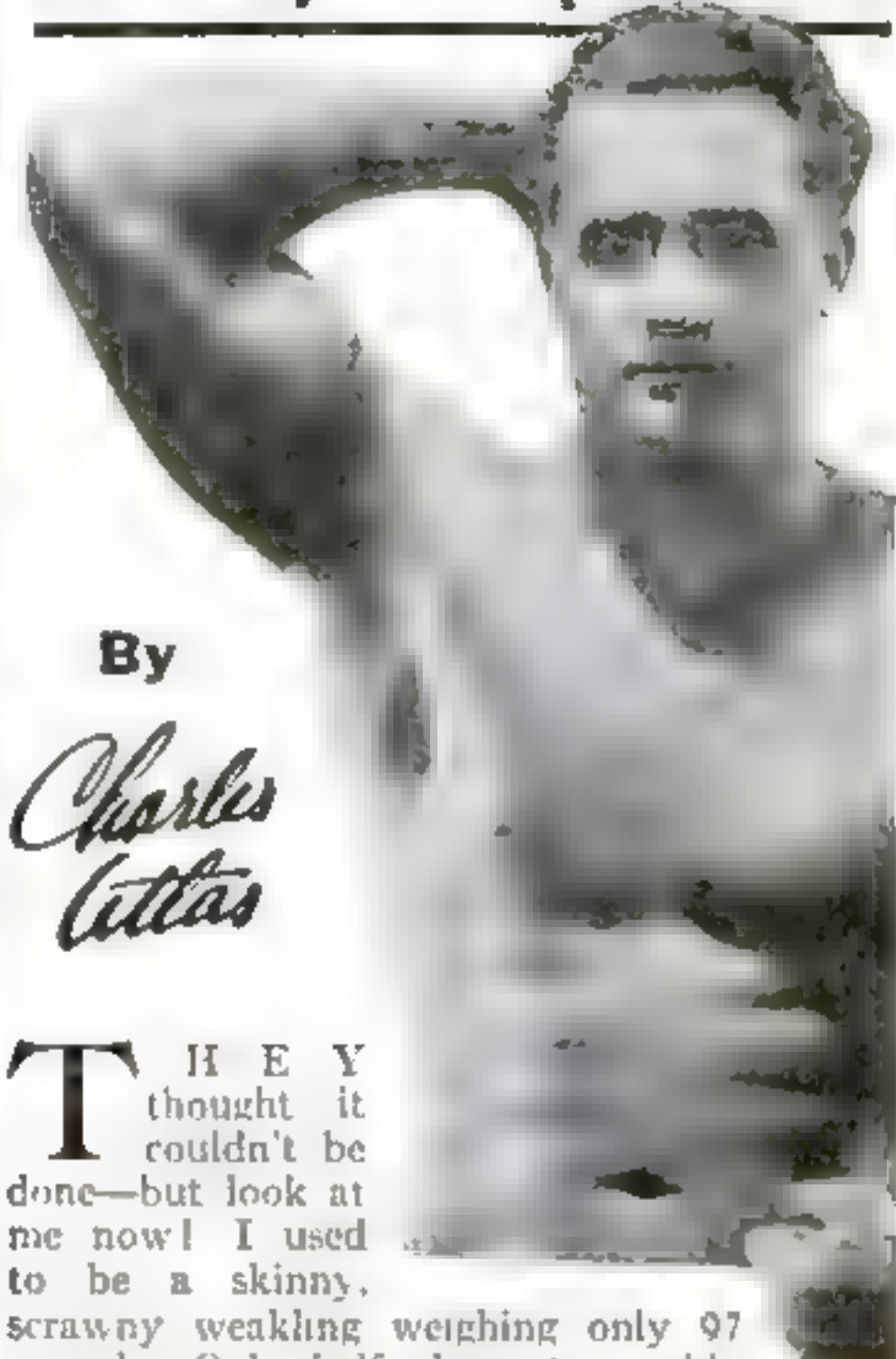
The *Blue Nose* is one of the fastest fishing schooners to sail the Atlantic Ocean. Built in 1921, it proved its racing ability the following year by winning the international trophy. The rigging is much simpler than that of a full-rigged ship so that it makes an ideal model for the craftsman who has had little experience, yet (Continued on page 16)



Kit 85 has all materials for building the fishing schooner model illustrated above

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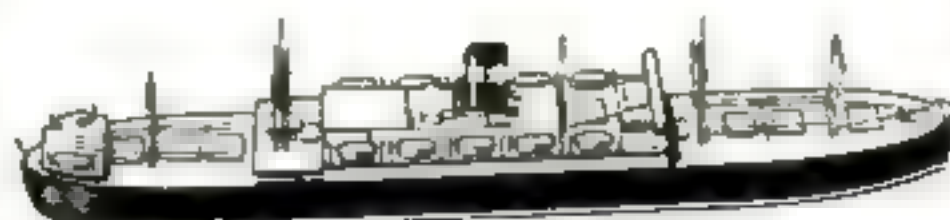
Our Construction Kits

(Continued from page 15)

it also has an appeal for the advanced model maker. The hull is 17½ in. long, and the overall length is 22 in.

Our kit for this beautiful model contains the hull lifts cut to approximate shape, all the necessary strip wood, spars, stock for making blocks and deadeyes, rigging cord, bell, anchors, steering wheel, mast rings, finished belaying pins and grating, flags, sailcloth, and other raw materials. The kit with blueprints and instructions costs \$4.95 (25 cents additional for shipping it west of the Mississippi River or to Canada).

For those who prefer simpler models, we offer the new Model-of-the-Month Club kit for the *President Lincoln* for



Kit 5M is for building a "president liner"

only \$1.50. It contains a partly shaped hull of sugar pine, all the necessary raw materials, and a blueprint. The model is 14¾ in. long.

A complete list of our kits follows:

MODEL-OF-THE-MONTH KITS

M. Aircraft carrier <i>Saratoga</i> , 18-in.	\$1.00
N. Four U.S. destroyers, each 6¼-in.	.75
O. Liner S.S. <i>St. Louis</i> , 11-in.	1.00
R. U. S. cruiser <i>Tuscaloosa</i> , 11¼-in.	1.00
U. <i>Hispaniola</i> , the ship in "Treasure Island," 7-in.	.50
Z. H.M.S. <i>Bounty</i> , 11½-in.	1.50
1M. Show boat, illuminated, 14-in.	1.50
2M. Ocean freighter, 14-in.	1.50
3M. Yacht <i>Nourmahal</i> , 8½-in.	1.00
4M. Oil tanker, 14-in.	1.50
5M. Liner <i>President Lincoln</i> , 14¾-in.	1.50

STANDARD SHIP MODEL KITS

A. Whaling ship <i>Wanderer</i> , 20½-in. hull, 27½ in. over all	7.40*
D. Spanish galleon, 24-in. hull, 30 in. over all	6.95*
E. Battleship U.S.S. <i>Texas</i> , 3-ft.	7.45*
G. Elizabethan galleon <i>Revenge</i> , 25-in. hull, 28 in. over all	7.25*
L. Farragut's flagship <i>Hartford</i> , steam-and-sail sloop-of-war, 33½-in. hull, 41 in. over all	8.45*
Q. Privateer <i>Swallow</i> , 12½-in. hull, 20 in. over all	4.95†
V. Clipper <i>Sovereign of the Seas</i> , 20½-in. hull, 26 in. over all	4.95†
Y. Trading schooner, 17½-in. hull	4.90†
2S. U. S. Navy destroyer <i>Preston</i> , 31¼-in. hull	5.95*
3S. <i>Constitution</i> ("Old Ironsides"), 21-in. hull, 31 in. over all	6.50*
4S. Clipper ship <i>Great Republic</i> , 31½-in. hull, 42 in. over all	8.40*
5S. Coast Guard patrol boat of new 165-ft. class. Full-hull model, ½-in. scale, the hull being 20% in. long	4.95*
6S. Brig <i>Malek Adhel</i> , ¼-in. scale, 20-in. hull, 33 in. over all, frame-and-plank construction; finely finished boxwood blocks, deadeyes, belaying pins, grating, etc., are included	9.75†
7S. Brig <i>Malek Adhel</i> , as above, but with sawed-out lifts for solid hull construction	9.75*

(Continued on page 17)

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Our Construction Kits

(Continued from page 16)



Kit V contains materials for a clipper

88. Fishing Schooner *Bluenose*, 17½-in. hull, 22 in. over all... 4.95†

SIMPLIFIED SHIP MODEL KITS

F. Liner S.S. *Manhattan*, 12-in. . . 1.00

H. Cruiser U.S.S. *Indianapolis*, 12-in. . . 1.50

J. Clipper ship *Sea Witch*, 13-in... 1.50

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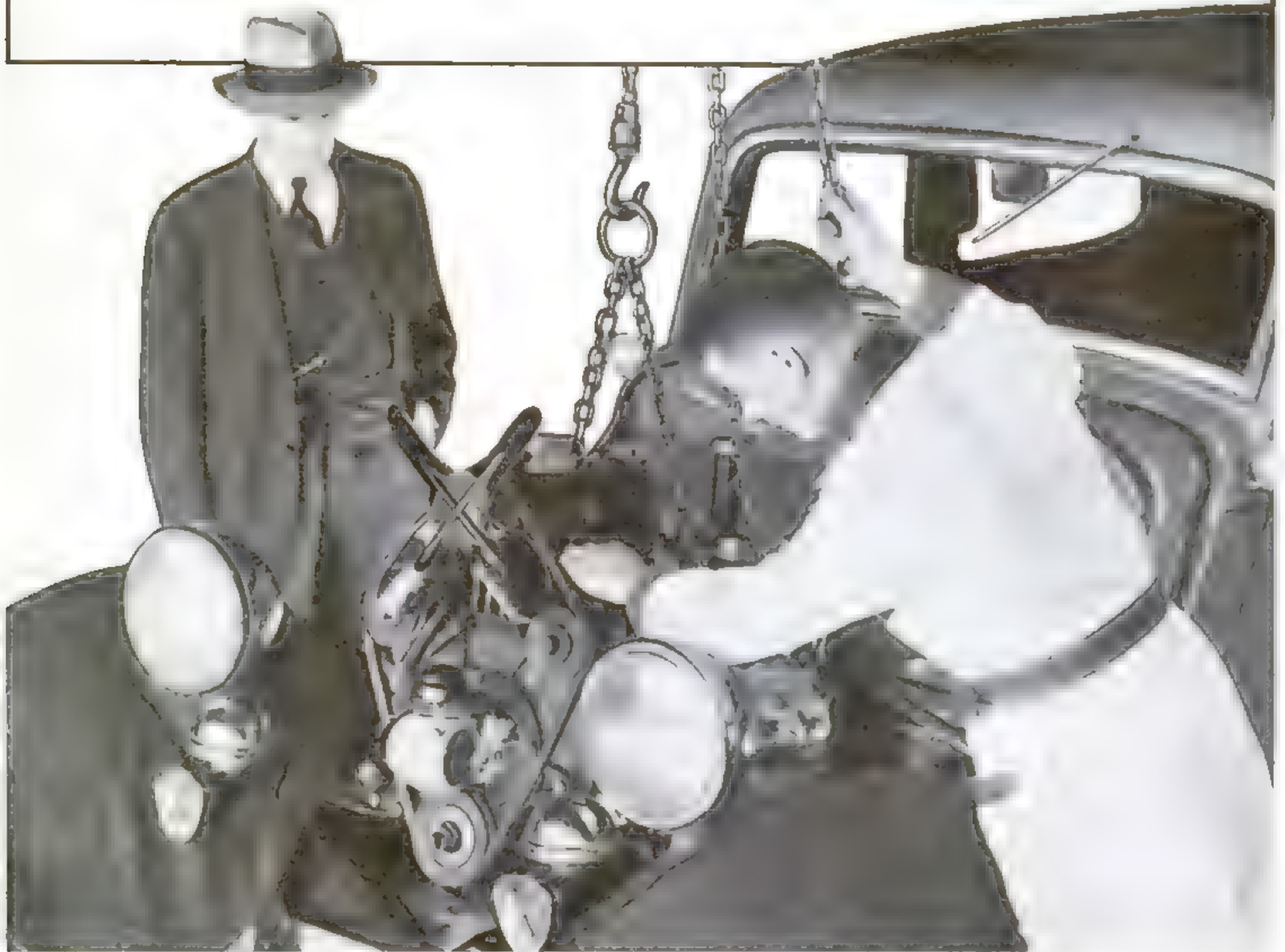
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POPULAR SCIENCE

Monthly

RAYMOND J. BROWN

Editor

THE MARVELS OF Underground Oil Railroads

BY EDWIN TEALE

THE SCENE is a pumping station on a 1,400-mile pipe line carrying gasoline from the oil fields of Oklahoma to large cities of the Middle West.

A telephone jingles. The station operator reaches for the receiver. Over the wire comes the voice of the chief dispatcher.

"Hello, Des Moines. Slug two goes to Whiting. Watch for the blue flag. It should reach you at 2:17."

At two o'clock, the operator begins sampling the torrent of fuel rushing northward through six-inch pipes. At 2:15, he notes a faint bluish tinge and at 2:18 the sample is indigo. With a whirl of a valve wheel, he directs the flow into a new channel and heads it for Whiting, Ind. Like a railroad switchman, the pipe-line dispatcher has shunted a shipment of gasoline to its destination. Dye, inserted in the fluid, formed the "flag" which showed where one batch, or "slug," ended and the next began.

Sometimes, as many as five or six different grades of fuel, each destined for a different city, follow one another through the same pipes at the same time. Moving at uniform speed and under high pressure, they mix but lit-



Laying a long-distance pipe line. At the top of the page, a mechanical ditch digger is scooping out a trench. Above, pipe being laid down like rope by a tractor derrick

tle at the points of contact. A single slug may run anywhere from 50,000 to 400,000 barrels and it moves through the pipes at about the speed of a walking man.

Today, for every mile of railroad track in the United States there are four miles of pipe lines. Carrying crude oil, natural gas, water, ammonia, steam, gasoline, and other commodities, this vast, underground system of transportation has an estimated length of nearly 1,000,000 miles. Gas now flows from the Texas panhandle to the factories of Detroit, and petroleum courses through channels of steel all the way from the Rio Grande to the skyscrapers of New York City. Pipes carrying gas and petroleum products alone would circle the globe ten times!

In South America, planters are sending coffee beans through pipe lines. In Germany, industrialists are transporting powdered coal through similar tubes. And, in the United States, large cities like St. Louis, Mo., and New York, N. Y., have refrigerating ammonia delivered underground like gas and water. Last year, more than seventy-five new or re-conditioned petroleum lines were added to the American

total. These long-distance conduits are the most intricate and interesting of all.

The largest are operated like railroads. They have their branches, terminals, and trunk lines. They have dispatchers, "track-walkers," switches, storage yards, and inter-connecting telephone, telegraph, and teletype systems. Synchronized pumping stations, located every forty miles or so along the right of way, keep the fluid moving at a constant speed. Many of the engines which drive the pumps are run on butane, an oil-field gas, which is slugged through the pipes under pressure in the form of a liquid.


Unlike tank cars, ships, and motor trucks, pipe lines do not have to carry themselves as well as their loads. Another factor in their efficiency is the reduced loss from evaporation. The fuel is safer underground, also. Add to these considerations the fact that the commodity travels faster and at a fraction of the cost of sending it by tank car, and it becomes apparent why pipe lines have spread so rapidly during the sixty-five years since the first petroleum line in the world was laid down in Western Pennsylvania, in 1862.

Three years before that, Col. Edwin L. Drake, a forty-year-old railroad conductor, had struck "black gold" near Titusville. Wells sprang up all along Oil Creek. Ten thousand people flocked into the region in three months. By 1862, there were 6,000 teams of horses hauling oil along mud roads of the region to the Allegheny River where the barrels were loaded on flatboats for transportation to market. Oftentimes, the teams formed such a continuous parade that people in villages along the way were unable to get from one side of the street to the other from morning until night. As roads became impassable, teamsters tore down fences and drove through the open fields. Soon, the whole valley of Oil Creek was churned into a vast quagmire in which horses struggled and floundered.


This was the situation, in 1862, when a refinery operator named J. M. Barrows laid a 1,000-foot pipe line from a well to his plant. Three years later, the initial "long-distance" line appeared. It was a five-mile stretch of two-inch iron pipe buried in the ground by Samuel van Syckel. With two pumping stations, it transported 800 barrels of oil a day.

These conveyors were long antedated by gas and water pipe lines, but they introduced the transportation of oil through underground tubes. It was not without opposition that these pioneers produced their innovations. The teamsters, seeing in the pipe lines a menace to their livelihood, broke them again and again. Only after Van Syckel set men with rifles patrolling the right of way was he able to keep his line in operation.


During the 1870's, pipe lines multiplied rapidly. They spread to Ohio and California. In the last years of the



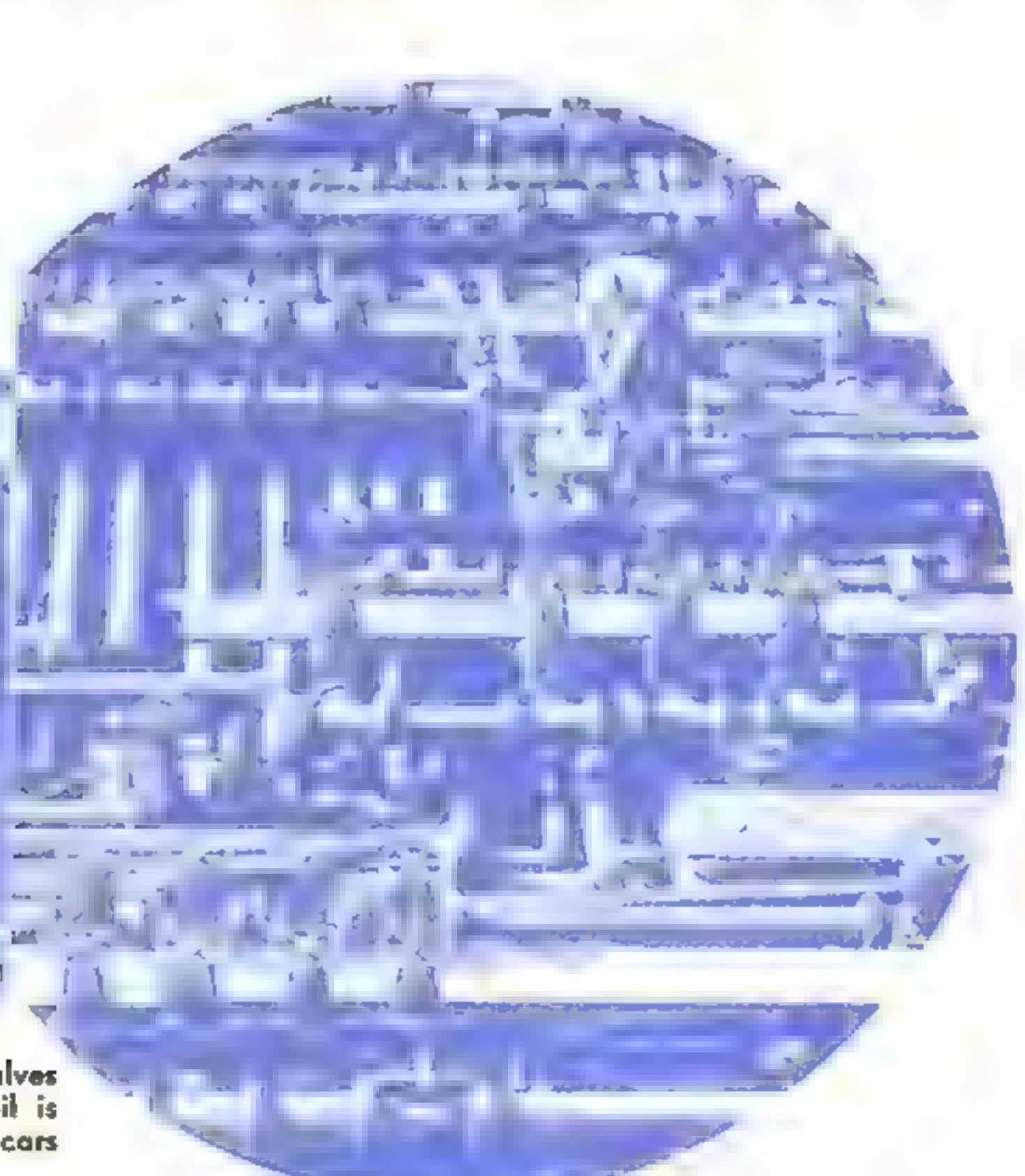
This specially constructed tractor is designed to lift the heavy pipe sections off trucks or flat cars and place them wherever required



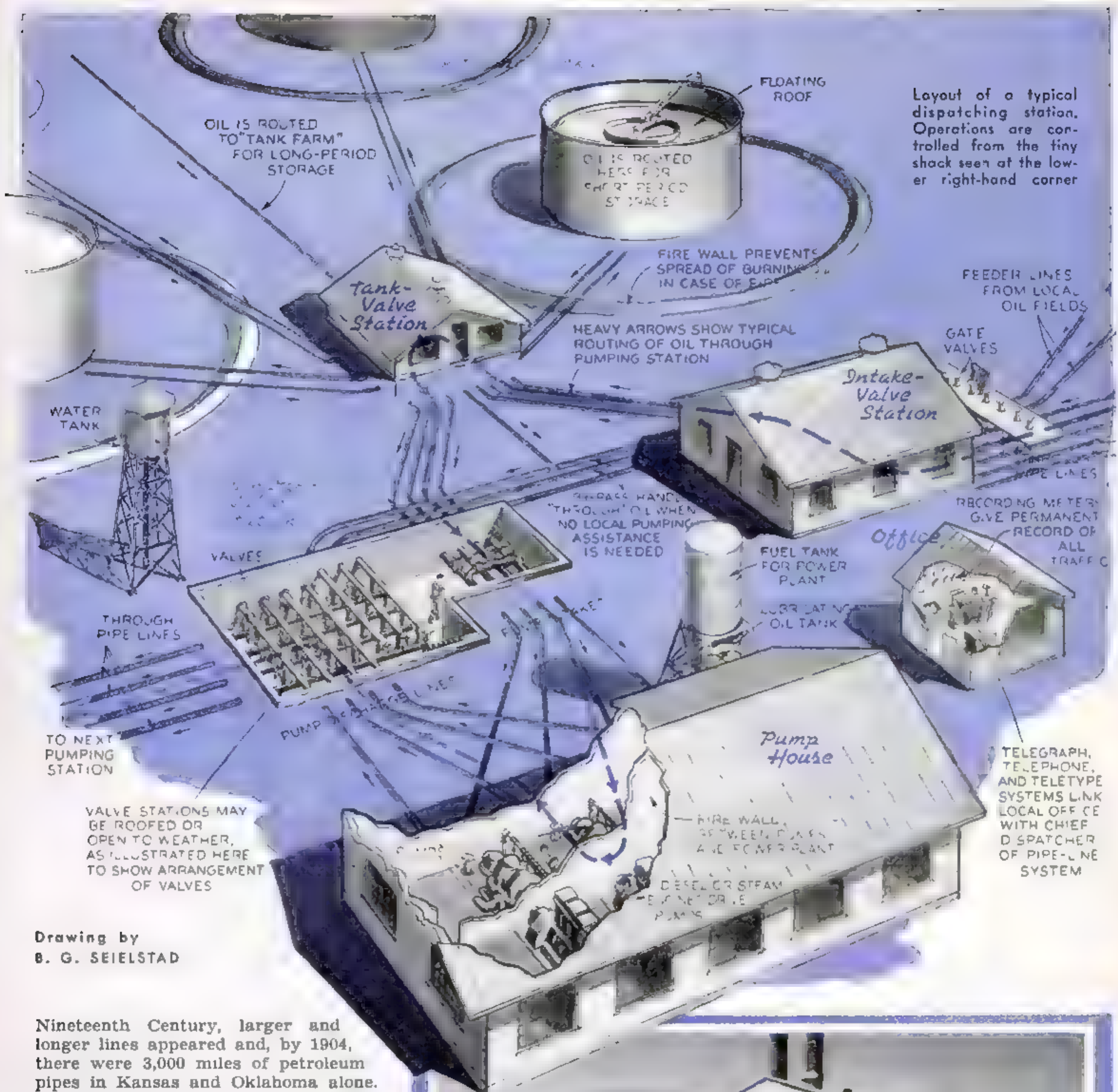
A welder at work closing the joint between two sections of pipe. Most pipe lines are welded throughout their length



Expansion joints, huge loops like those seen at the right, allow for stretching and contraction from heat and cold



Part of the maze of pipes and valves at a dispatching station, where oil is shunted like strings of train cars



Drawing by
B. G. SEIELSTAD

Nineteenth Century, larger and longer lines appeared and, by 1904, there were 3,000 miles of petroleum pipes in Kansas and Oklahoma alone.

Today, a pipe-line map of America shows a vast steel spider web forming one of the greatest and one of the least known transportation systems on earth. The chances are that you often cross over these buried arteries of traffic without knowing it.

The modern pipe line runs everywhere. It crosses swamps, dives under rivers, climbs mountains, burrows beneath city streets. One California line even runs along the sheer face of a cliff, supported from above by cables. Others go out upon the bed of the ocean for half a mile to supply oil direct to anchored vessels.

The construction of pipe lines—under the sea, across deserts, in the mountains—forms one of the epic chapters in the history of engineering. Last year, workmen, driving a line through the swamps of Louisiana, waded up to their waists in ooze and silt. They had to haul sections of welded pipe across bayous on (Continued on page 126)



Pipe lines running into a refinery yard, like tracks in a busy rail terminal. Crude oil flows in from the wells, and gasoline is pumped out to the distributing centers

Why We Enjoy Pain

MODERN PSYCHOLOGY TRACES COMMON HABITS TO SELF-TORTURE

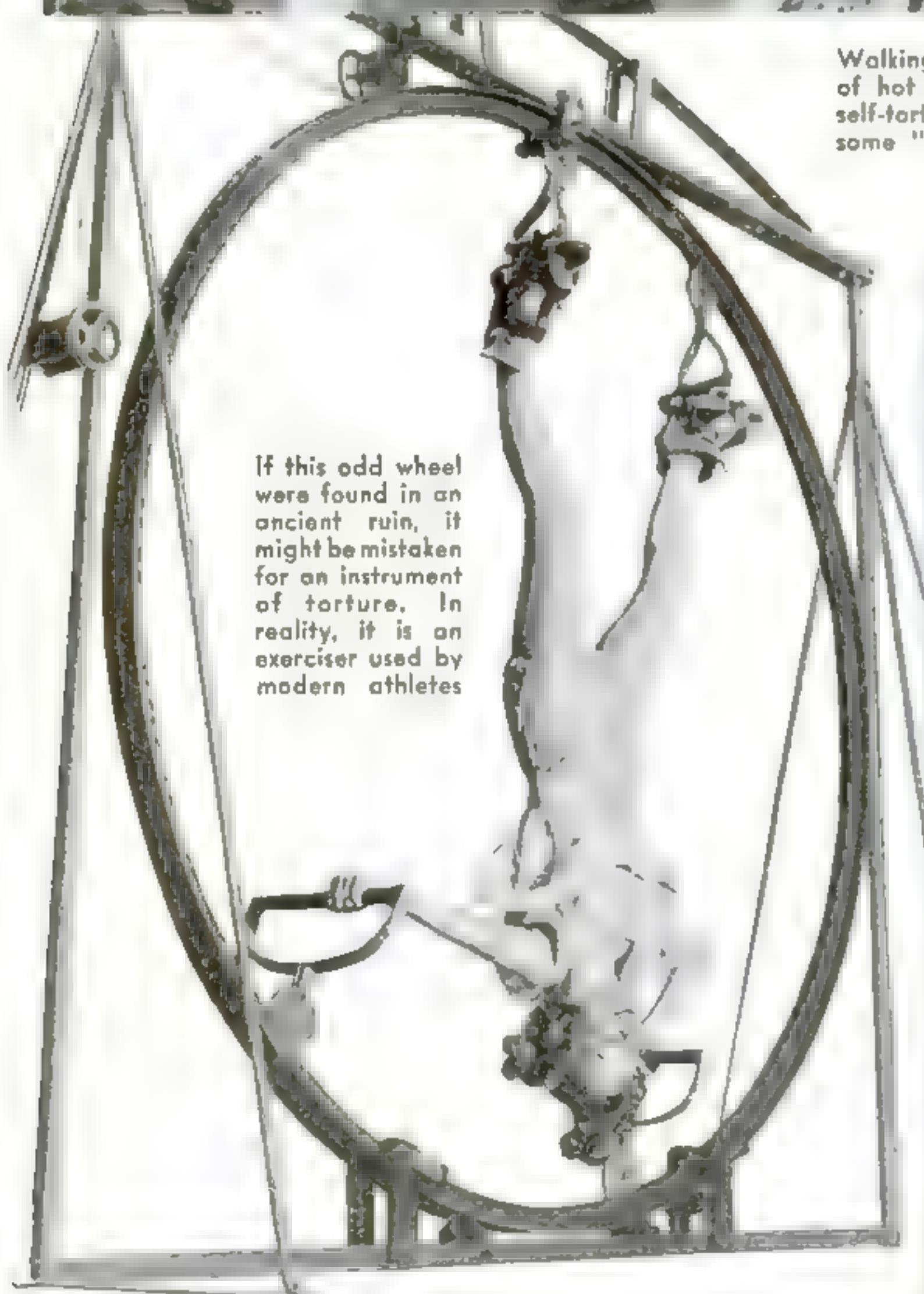


Walking barefoot on a bed of hot coals is a form of self-torture practiced by some "holy men" of India

DO YOU like to torture yourself? Shudder if you will at the thought of lying on sharp spikes, or walking barefoot across hot coals, as "holy men" of India do—yet, in milder ways, nearly everyone indulges in some form of self-torture. Inflicting injuries and pain upon ourselves seems to be an almost universal human urge, according to Dr. Casimir Dabrowski, Polish psychologist and former research fellow of the Rockefeller Foundation at Harvard University.

Of our own free will, we undergo physical and mental tortures that would be outrageous if they were forced upon us, he points out. We pick our skin, tear at our hair, and bite our nails and lips. We must enjoy being scared half to death, for we are willing to pay for the privilege, when we ride a roller coaster at an amusement park. Science has contributed its bit to the art of self-torture with an ingenious little toy called an "electric thriller," which administers a harmless but tingling high-voltage shock to the volunteer victim who grips a pair of metal handles!

Why do we torture ourselves? One reason is to show off, Dr. Dabrowski



If this odd wheel were found in an ancient ruin, it might be mistaken for an instrument of torture. In reality, it is an exerciser used by modern athletes



People must enjoy being scared half to death, or they wouldn't pay to ride on the roller coaster at an amusement park



An Indian fakir walking on stilts made of sharp spikes, to demonstrate "saintliness"

finds. Parents might be horrified if they saw some of the "games" that children devise to see who can bear the most punishment—beating each other with rods upon the soles of the feet, or sticking pins into their fingers. Yet many of these same parents pride themselves highly upon a compliment from the doctor or dentist upon their fortitude in bearing pain.

Savages submit to cruel "ordeals" to prove themselves worthy to be warriors or members of select tribal societies. Are we more civilized? There is no dearth of candidates for college fraternities and other secret orders, whose initiations sometimes seem to the victim to be patterned along painfully primitive lines.

Misdirected muscular energy accounts for some of the most familiar forms of self-torture. Watch a nervous man fidgeting over a book or a mental problem. You may see him biting his nails, scratching his head, or winding a watch chain so tightly around his finger that it bruises the flesh. Some actual irritation—a healing wound or an aching tooth—may first suggest the



Misdirected excess energy causes nervous people to bite their lips and finger nails, and accounts for some of the most commonly seen forms of self-punishment

habit. Then we pick the scab, pinch the sore place until it hurts, or work upon the tooth with the tongue, and the self-torturing habit grows upon us. What we need, says Dr. Dabrowski, is simply a more healthful outlet for this natural, pent-up desire for muscular activity, such as sports and games.

"I could kick myself," says the man who has trumped his partner's ace at bridge, or has unintentionally wounded a friend's feelings—and many of us actually carry out the impulse to punish ourselves for our misdeeds. Cases are on record of people whose sense of guilt, at some real or fancied shortcoming, has prompted them to such curious forms of self-torture as putting salt in their coffee and tea, sleeping on hard boards, and lifting heavy stones. Harming ourselves to spite someone who is fond of us is another trait familiar to psychologists.

Mental anguish that people inflict upon themselves, from motives as varied as those from which they submit to physical pain, runs the gamut from whimsical little foibles to the most ex-



A nervous man often will twist a watch chain around a finger until he bruises the skin



Science has contributed to the art of self-torture in a toy that administers a tingling electric shock through electrodes

quisite refinements of self-torture. One man, by preference an ultraconservative dresser, enjoys "shocking" himself now and then by donning a necktie of atrociously loud pattern. Another man treats himself more harshly by destroying, on the merest impulse, his most treasured possessions. Still others deliberately seek to place themselves in situations where they will be insulted and humiliated.

As opposed to fanatical extremes of self-injury, harmful to physical health or to moral dignity, Dr. Dabrowski finds much that is beneficial in mild "self-torture" from worthy motives. In this class he places the character-building forms of self-denial inspired by religious teaching; and the self-discipline that drives great artists and scientists, inventors and explorers, idealists and reformers, to complete difficult tasks.

Army's Biggest Bomber Has Rotating Nose

MACHINE-GUNNING acrobatics help defend the U. S. Army's latest bombing planes from hostile aircraft. Not only does the gunner at the prow of the ship enjoy the advantage of a horizontally revolving turret, but the entire transparent nose of the plane can be rotated so that he may train his weapon upon an enemy machine approaching from any conceivable angle. Carrying a total of five machine guns and a ton of bombs, the new four-motored planes are called the fastest and most powerful bombers in the world.



Close-up of new U. S. Army bomber, showing rotating nose sheathed in shatterproof glass

At left, the plane in flight. Right, how the turret can be turned to fire at various angles

Spray Gun Helps Clean the Teeth

DESIGNED to supplement the use of a toothbrush, a dental spray gun has been devised by a German inventor. Pressing a trigger releases a liquid jet that flushes out crevices of the teeth, and bubbles of carbon dioxide gas in the fluid provide a stimulating massage for the gums. The device generates its own pressure when prepared tablets are dissolved in its water reservoir. Individual nozzles are supplied for various members of a family.



Carbon dioxide gas supplies pressure for this tooth spray

A MECHANICAL bugler rouses soldiers stationed at the U. S. Army Air Corps base at Mitchell Field, N. Y. To replace the human "sleep destroyer," reveille, taps, and other calls are recorded on disks. Reproduced by a phonograph, the sounds are amplified and blared out through giant loudspeakers. The photograph shows a former bugler listening to the device that took his job.

Phonograph Sounds Bugle Calls



A former bugler listening to the device that took his job

Giant Two-Hulled Gliding Boat Carries 150 Passengers

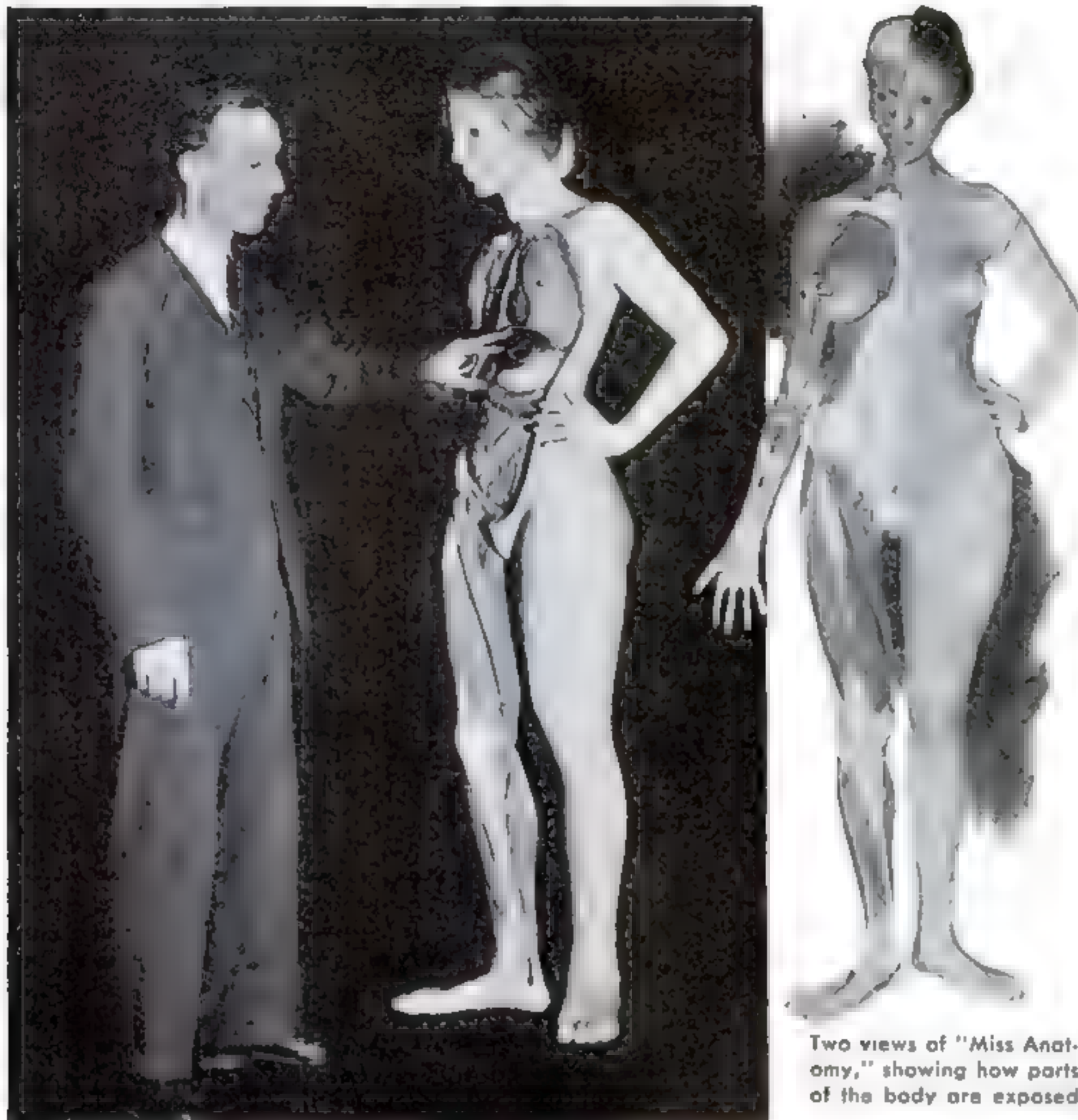


Model of a novel speedboat being built to carry passengers between Russian resorts on the Black Sea

CARRYING 150 passengers at a forty-mile-an-hour clip, a giant speedboat of strange design will soon skim Black Sea waters to link the Soviet resort cities of Sochi and Sukhum. The model pictured at the left shows how the twin-hulled

craft, now under construction, will appear when completed. It will measure eighty feet long and forty feet wide, and will be driven by four giant gasoline motors developing 675 horsepower apiece.

Anatomical Statue Shows Structure of the Human Body



Two views of "Miss Anatomy," showing how parts of the body are exposed

MODELED from life, an anatomical statue of a female figure, recently displayed at the New York Museum of Science and Industry, is designed to demonstrate the positions and functions of the organs, bones, and muscular structure of the human body. By a complicated lighting system, each part of the body is spotlighted in turn as a lecturer discusses its structure and purpose. Chest wall, muscles, lungs, heart, brain, and other units are removed to show underlying parts, and each organ comes apart to display its main sections. A supplementary exhibit demonstrates the operation of the human nervous, respiratory, and digestive systems.

Biggest Flower of All Blooms in New York



A masked reporter examining the big bloom

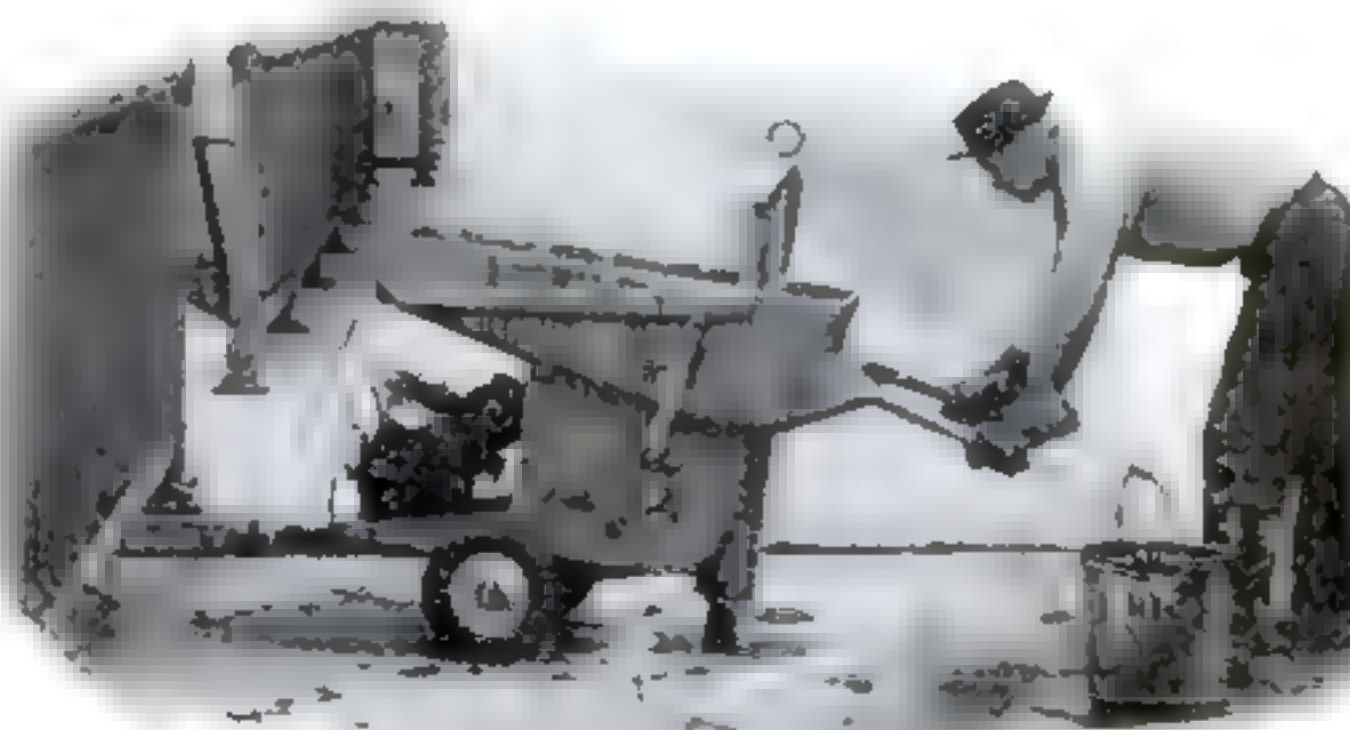
FOR the first time in the United States, a specimen of the world's largest known flower recently burst into bloom under the gaze of scientists in the Bronx Botanical Garden in New York City. Standing eight feet, five inches high, the Gargantuan bloom, whose scientific name is *Amorphophallus Titanum*, is a rare plant native to the island of Sumatra in the Dutch East Indies. Some of the observers wore gas masks to protect them against the flower's nauseating odor.

Alligators Get Foot Warmer

SIX HUNDRED feet of electric heating cables, laid in the sand floor of the reptile house at a Chicago zoo, warm the feet of alligators, turtles, and other inmates. Cold feet, it has been found, make the animals sluggish.

Mud Jack Raises Sunken Sidewalk Slabs

SUNKEN concrete sidewalk slabs that form a hazard to pedestrians are raised to their correct grade by a new mud-jack machine. The unit pumps a mud mixture through holes bored in the concrete, to provide a new foundation for the slab and raise it to its original level. The process is said to eliminate the necessity of removing and replacing the sunken section of heavy concrete paving.



Mud is pumped through holes in the concrete to force slabs upward

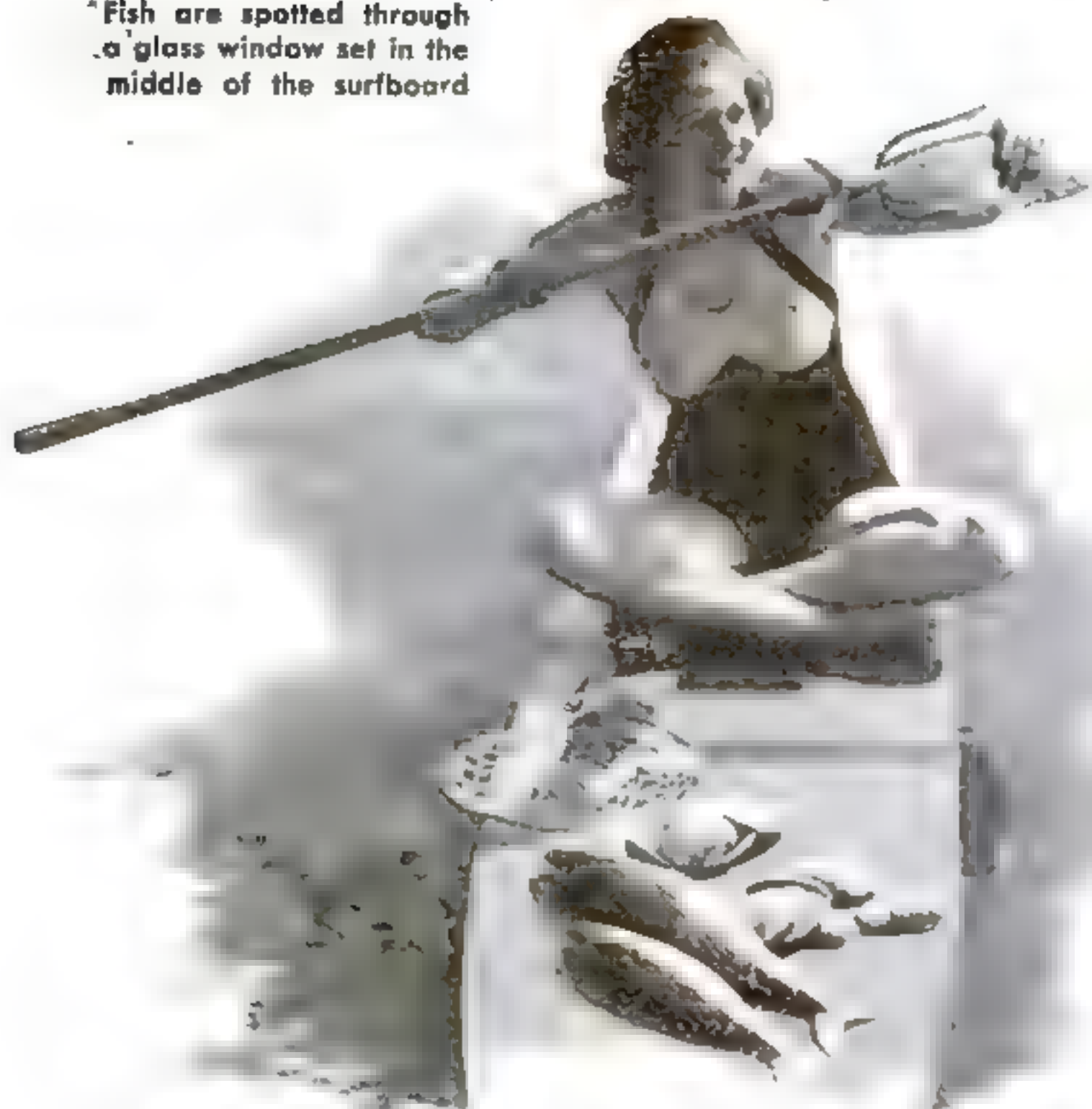
Chemical Worker's Job Is to Smell Water

SMELLING WATER is the novel occupation of Harry Laughlin, of Tyrone, Pa. Laughlin works for a chemical concern that manufactures activated carbon, an agent widely used for removing obnoxious odors from water supplies. Because of his acute sense of smell, he is employed to detect faint odors in water samples. So far, he has sniffed out thirty different kinds.



Harry Laughlin sniffing water to classify faint odors

Fish are spotted through a glass window set in the middle of the surfboard



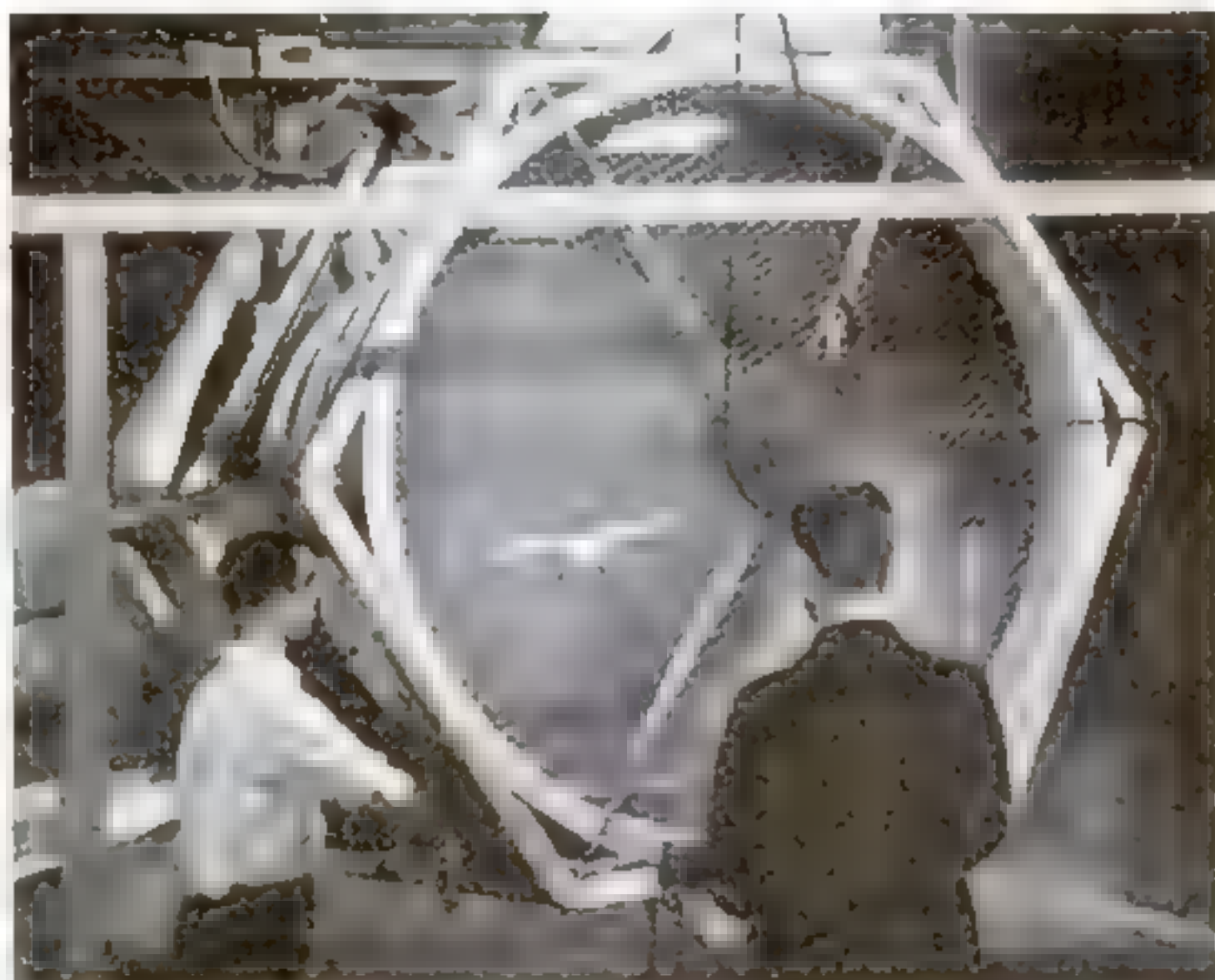
Surfboard Fishing Is New Sport

SPEARING fish while riding an ocean surfboard is an exciting new sport that is gaining popularity at an Atlantic beach resort. Floating on offshore currents, the rider sits with spear poised while trying to spot a swimming target through a special window that is set into the center of the board and gives a clear view of the waters beneath. The fishing equipment consists of a spear and a hand net.



Wind Tunnel Tests Plane Models In Flight

EXPERIMENTAL plane models fly freely in a magnetic wind tunnel just developed by the National Advisory Committee for Aeronautics at Langley Field, Va. Instead of being suspended on wires, the model takes off and flies by itself in the air stream. Tiny electromagnets in the plane's wings, which operate the ailerons and rudder, are electrically controlled to make the test model maneuver like a real ship in actual flight.



An electrically controlled model undergoing a test in the wind tunnel

"Sparkless" Wrenches Prevent Explosions

SAFETY WRENCHES that will not cause sparks when struck against metal surfaces have been introduced for use in shops and factories where inflammable gas or explosive materials form a constant hazard. Made of an alloy of copper and Beryllium, the tools are manufactured in a variety of sizes and are said to be practically as strong as conventional carbon-steel types. The "sparkless" wrenches are also nonmagnetic and noncorrosive, it is claimed.

"Artificial Man" Trains Dogs

DOGS destined to serve as guides for blind persons get their preliminary training with an "artificial man," in a method worked out by a German psychologist. Dragging a cart about as high and as wide as a man, the dogs learn to avoid any obstacles on the ground or overhead that would strike any part of a master's body and thus interfere with his progress.

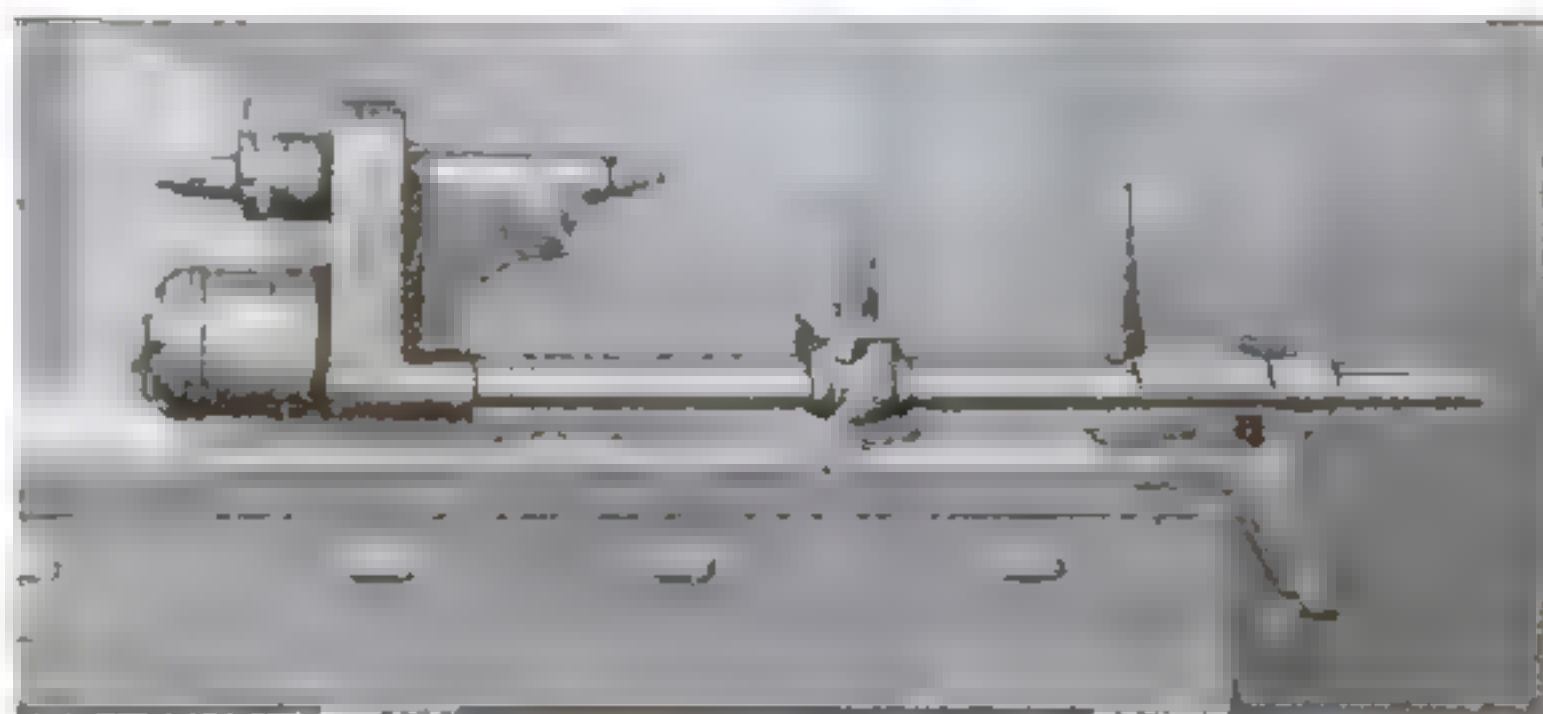


Wires Spliced Quickly With Plierlike Device

WIRES are quickly spliced with a new tool developed by the Bell Telephone Laboratories in New York City. A sleeve, slipped over the bare ends of two wires, is tightly compressed by the viselike action of the splicer into an airtight casing that insures a perfect electrical contact.

New Tool Is Drill Press and Lathe

POWERED by an electric drive that provides any speed between 400 and 4,000 revolutions a minute, a new tool for home workshop fans, when attached vertically to a workbench, serves as a drill press—and for mortising, routing, and shaping. Swung and locked into a horizontal position, it becomes a lathe when tool rest and tailstock are added. Other attachments permit sawing, jointing, sanding, and grinding.



Horizontally, this new tool serves as a lathe. Vertically, it is a drill press, as at the right



Novel Traffic Light Is Portable



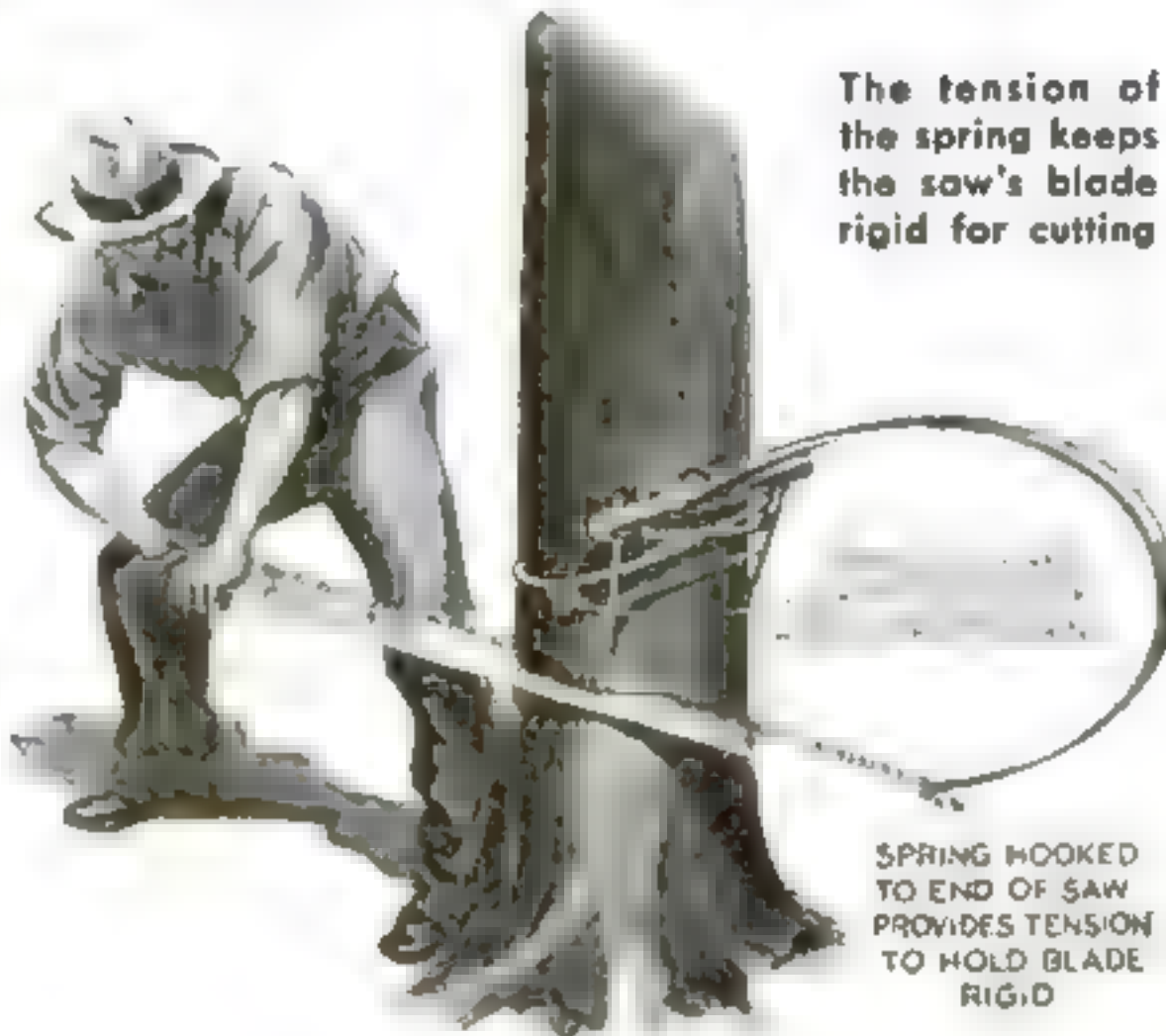
This traffic signal is set up when needed, as pictured at the left

A PORTABLE traffic light has just been developed for use near schools and at other highway points where congestion is periodic and does not warrant a permanent installation. Light in weight, the unit is plugged into an electric outlet installed in the pavement and normally covered by a metal cap. The traffic-light housing can be detached from the column on which it rests for ease in carrying from one location to another. A handle on the top of the light makes it easy to transport.



Spring Helps One Man Saw Tree

CLAMPED to a tree trunk by tonglike arms, the leaf spring of a new device acts as a helper to permit one man to fell the tree with a one-handed crosscut saw. The free end of the spring is hooked into a hole in the free end of the saw blade, and provides tension to hold the blade rigid as it is moved back and forth. When the tree falls the apparatus is easily removed from the trunk.



The tension of the spring keeps the saw's blade rigid for cutting

SPRING HOOKED TO END OF SAW PROVIDES TENSION TO HOLD BLADE RIGID

Bathing Suit Fits Any Figure

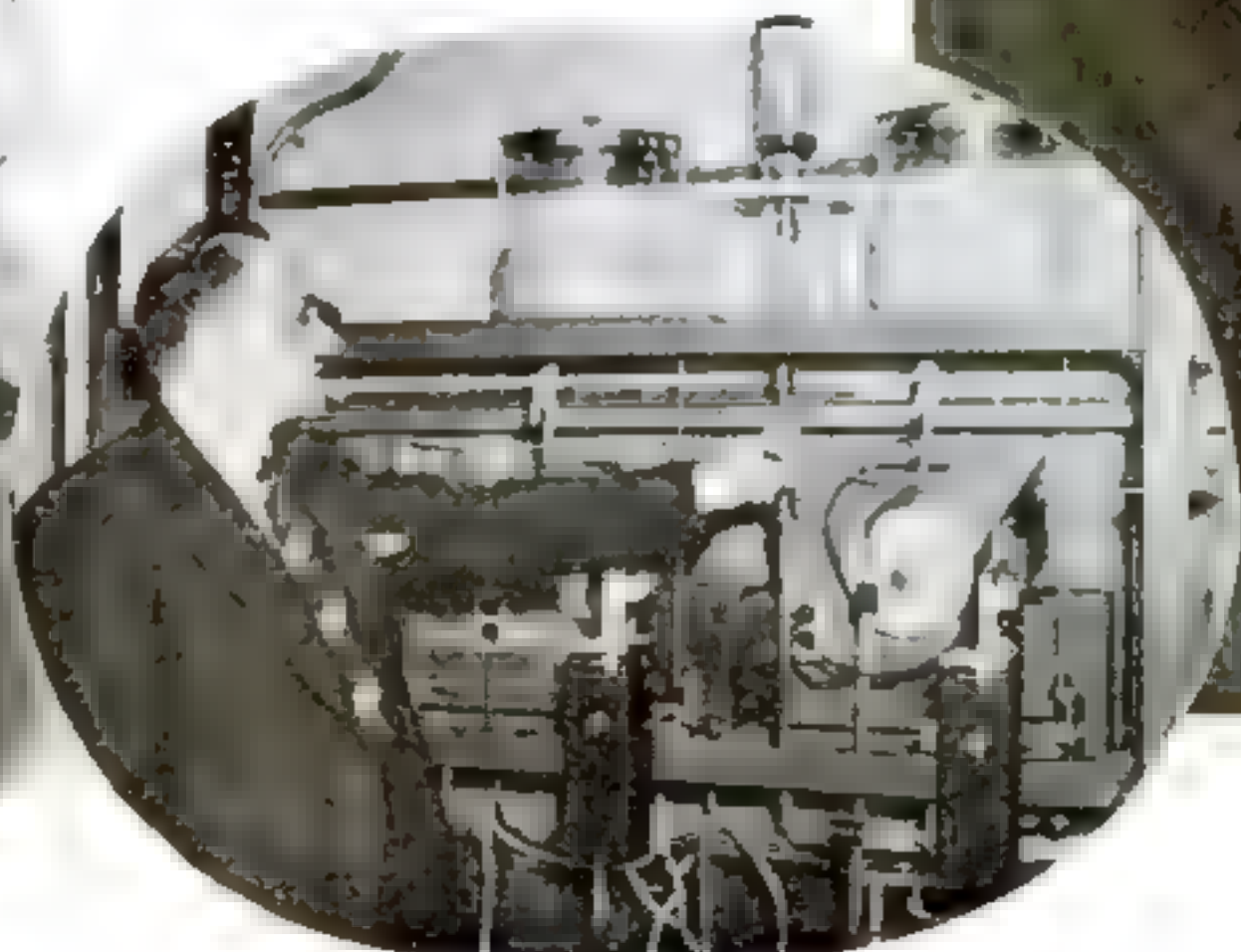
BATHING SUITS made of a new elastic material are said to fit any figure, regardless of size. The photograph above shows how the suits fit Dorothea Kent and Alice La Mont, screen players, who vary in weight by 100 pounds.

Vibration Strengthens Concrete

STRENGTH of a concrete pavement can be increased as much as ten percent by applying vibrators, similar to those used in beauty treatments, to the concrete as it is laid, according to tests conducted by the U. S. Department of Agriculture.

Mechanical Bartender Mixes Drinks in Automatic Bar

MIXED DRINKS are served by an automatic bar just installed in a New York City restaurant. When the customer places the required number of nickels in a slot, cocktail ingredients in correct proportions flow from bottles mounted behind the unit, and mix together as they flow through glass pipes and out of a spigot into the waiting glass. A refrigerating unit keeps the beverages cool.

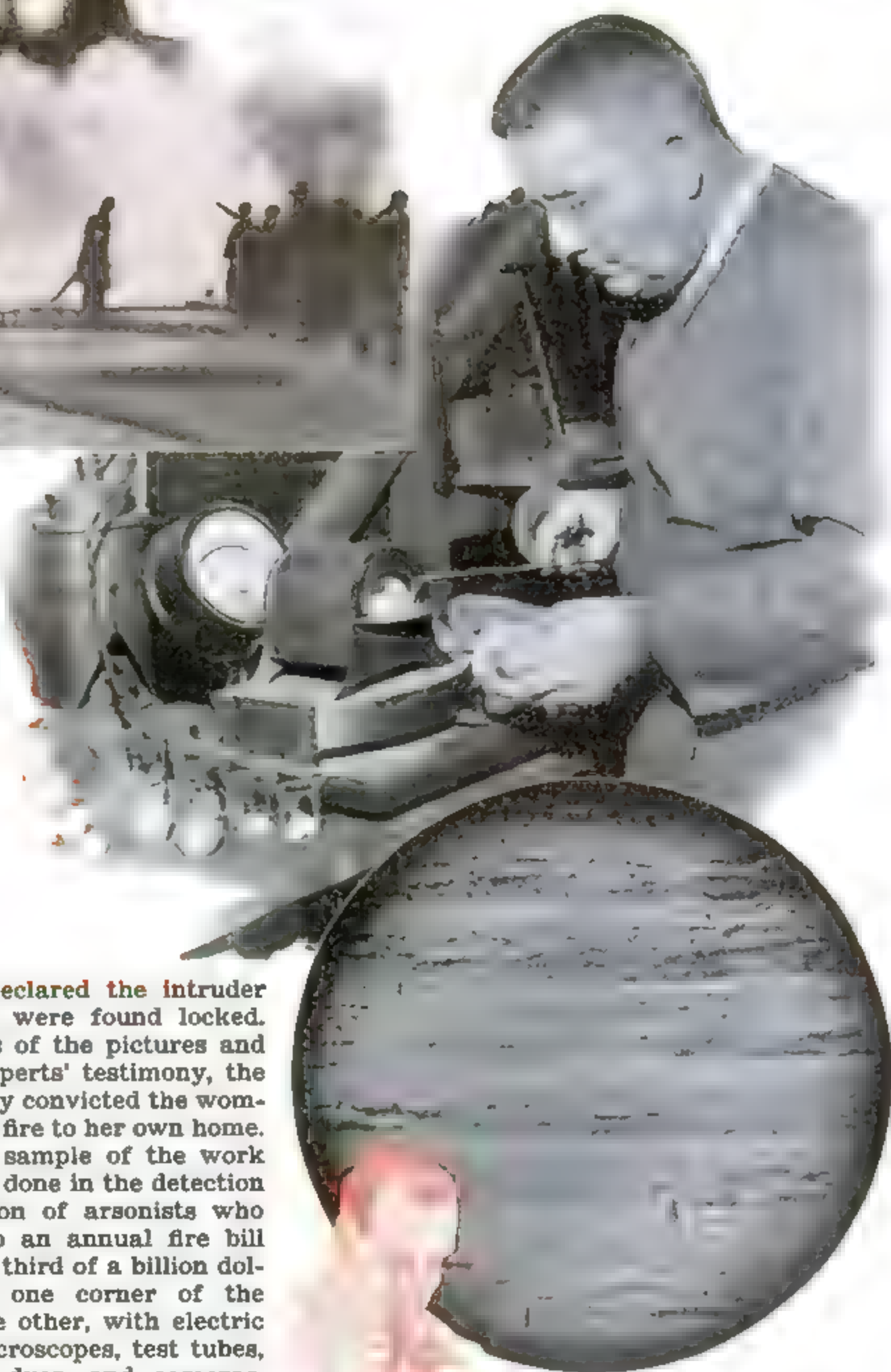


A demonstration unit of the automatic bar. Pictures at the left show beer kegs with glass connecting tubes, and the intricate mechanism that mixes cocktail ingredients



Clews to many mysterious fires are unearthed in the laboratory. Below, Capt. Paul Wolfe, arson expert, is heating samples of wood in an electric oven to observe "fingerprints" left by various degrees of heat

Fire-Bug Hunters



ONE night, not long ago, on a quiet street in Pasadena, Calif., fire broke out in the bedroom of a large old mansion. When firemen entered the house a few minutes later, they found an aged woman, bound and gagged, struggling on the floor to escape the flames which were rapidly creeping toward her.

"A burglar," she gasped. "He tied me up and left through those windows."

Next day, in two Los Angeles laboratories, arson sleuths, skilled in identification of woods and of the inflammable materials used to start fires, bent over electric ovens and worked with a microtome, a delicate instrument that slices wood to a thickness no greater than a thousandth of a millimeter.

Several weeks later, the wood experts faced the woman in a criminal court. "This defendant," they declared, "poured kerosene on the white-pine floor of a closet, dropped a burning match, and bound herself. There was no burglar."

With photomicrographs, they demonstrated to the jury the cell structure of the wood from the closet. Greatly enlarged views of the wood's surface showed "alligatoring," a peculiar marking resulting from burning kerosene, proving conclusively that the fire had been started deliberately in the closet. Furthermore, the windows through

which she declared the intruder had escaped were found locked. On the basis of the pictures and the arson experts' testimony, the jury promptly convicted the woman of setting fire to her own home.

That is a sample of the work that is being done in the detection and conviction of arsonists who contribute to an annual fire bill running to a third of a billion dollars. From one corner of the nation to the other, with electric furnaces, microscopes, test tubes, microtomes, dyes, and cameras, the fire sleuths are making arson so unpopular that the fire toll has been reduced by scores of millions.

In every section of the country, technicians work hand in hand with fire experts to develop new and better methods of arson detection. It was Capt. Paul T. Wolfe, director of the arson bureau of the Los Angeles fire department, and Ralph Minnier, a consulting wood technologist, who, working together, supplied the evidence which proved the guilt of this Pasadena woman. Experimenting over a period of years, Capt. Wolfe has determined precisely how each type of incendiary material leaves its "fingerprints" on burned wood. He has made hundreds of tests, soaking blocks of wood with such liquids

as gasoline and kerosene, and burning them under gas jets.

By means of electric thermometers attached to electric ovens, the heat of combustion of various materials was measured. Wood normally burns at 1,500 degrees, it was found, but when some inflammable substance is poured on its surface, greater heat is produced. Gasoline, for instance, causes it to fall within the 1,550-1,600-degree range; kerosene produces 1,650 to 1,800 degrees. Thermite, a mixture of fine-grained aluminum with a metallic oxide, carries the temperature to 3,500 degrees. And

"Alligatoring," telltale cracks on the surface of charred wood, as disclosed by the microscope

with each increase in heat, the "alligatoring," or characteristic marking left on the charred wood, decreases in size.

Whenever incendiaryism is suspected, the fire sleuths first determine where the fire started and cut away a section of burned wood. Back in the laboratory, this is examined under a microscope. If the charred surface resembles the skin of an alligator, consisting of individual, concave leaves, smaller than a silver dollar, they know that abnormal heat has been involved.

Recently a building containing a large stock of patent medicine burned. Firemen went through the ruins carefully and found that in spots the wood had burned to a white, powdery ash; even the concrete had melted, running like water over the ground. "From our experiments, I knew that only thermite could reduce the wood fiber to such an ash, or melt concrete," the arson expert explained.

Several weeks ago fire broke out at midnight near the front door of a small dwelling. This, alone, suggested arson, and the woman who occupied the place named her former husband as a likely culprit. Before morning the man faced the investigators, protesting that he had not been near the house for several months. His mother declared that he had not left her home that night. When searched, he yielded no clew more damaging than a small splinter, caught in his left trouser leg.

Next morning, a laboratory expert clamped the splinter in his microtome and sliced away a section four one-thousandths of a millimeter thick. Applying a red aniline dye, he placed the tiny section under his microscope, enlarged it 450 diameters, and studied the cell structure. Again, he sliced off a thin section from a piece taken from the door jamb of the house, applied the dye, and examined it. The two pieces matched perfectly. Confronted with this overwhelming proof that he had visited the house, the man confessed.

Experts who for a decade or longer have been running arsonists to earth

Armed with all the weapons of science, arson experts are waging war on a form of crime that adds millions of dollars to Uncle Sam's enormous annual fire bill

By ANDREW R. BOONE

can guess with uncanny accuracy the nationality, and even the sex, of the persons responsible for an incendiary fire. A woman, for instance, is likely to leave the whole contents of a box of matches in a pile of paper to speed the fire along, when two or three matches would do the job and leave a thinner trail of evidence. A Sicilian probably will pour 100 gallons of gasoline through a building when one gallon would be adequate. Americans often set their blazes with some timing device, most of which the arson detectives consider "laughable contraptions."

These fires, you say, are of no interest to you. They should be, for America's annual fire loss equals half the interest on all savings. There are more than 8,000 arson fires every year, and because of them you pay higher insurance premiums on your own home. Some authorities say one fire in five is incendiary.

Criminal rings engage "professionally" in fire-setting. They pro-

ceed by first conducting research into a prospective customer's business affairs. If he is losing money and cannot pay his bills, or has been denied a loan at the bank, a solicitor approaches him, and sounds him out. If he takes favorably to the suggestion, the solicitor closes with instructions something like these:

"Borrow (Continued on page 115)



In the ingenious arson device above, a razor blade attached to the clapper of a telephone bell cuts a string and releases a weight that scratches some matches to start a blaze. Left, experts hunting clews at the scene of a fire



Remains of a baby carriage in which an apartment-house fire was started. Left, experts trying to identify a sample of wood by means of photomicrographs showing various cell structures



MODEL VILLAGE



Seeming to stretch far away into the distance, the miniature landscape represented by this novel "diorama" is animated with moving cars, boats, and trains



Model automobiles attached to endless chains that pull them around an oval frame to pass before spectators. At the right, an artist is putting finishing touches on a human figure

BOATS, trains, motor-cycles, and automobiles wind through 150 square miles of New England countryside condensed into an animated advertising display only twenty feet long and eight feet deep, recently constructed in New York City by Edward H. Burdick. Moving through a realistic miniature background of farmhouses, churches, trees, and rolling hills—all built in accurate perspective to give a three-dimensional effect of depth—three separate sets of vehicles run on motor-driven endless chains help to create the illusion of distance. The observer sees cars whiz past on a highway in the foreground, reappear in diminished size in the middle distance, and finally—this time reduced to tiny proportions—drop out of sight over the brow of a "far-away" hill. Suddenly a car races by, swerves out to pass another car, just avoids a smash-up, and careens out of sight with a motor-cycle policeman in hot pursuit, while a hidden siren wails. Finally, the lights dim and a cloud on the painted sky backing serves as a screen for a short motion picture illustrating the services offered motorists at filling stations of a large oil company.

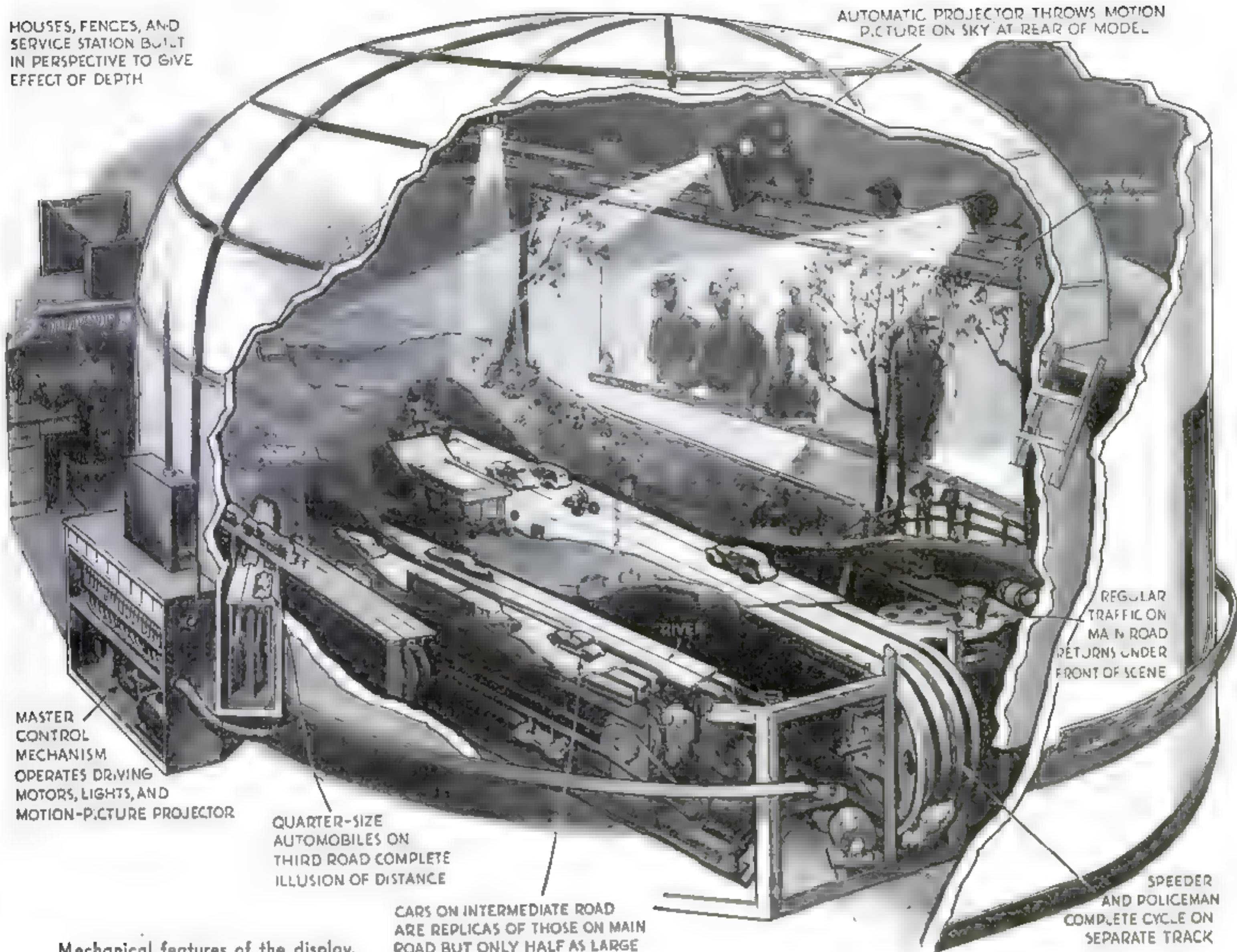


Trees being "planted" in the tiny New England village. The buildings are designed in perspective to give a realistic effect of being at a distance

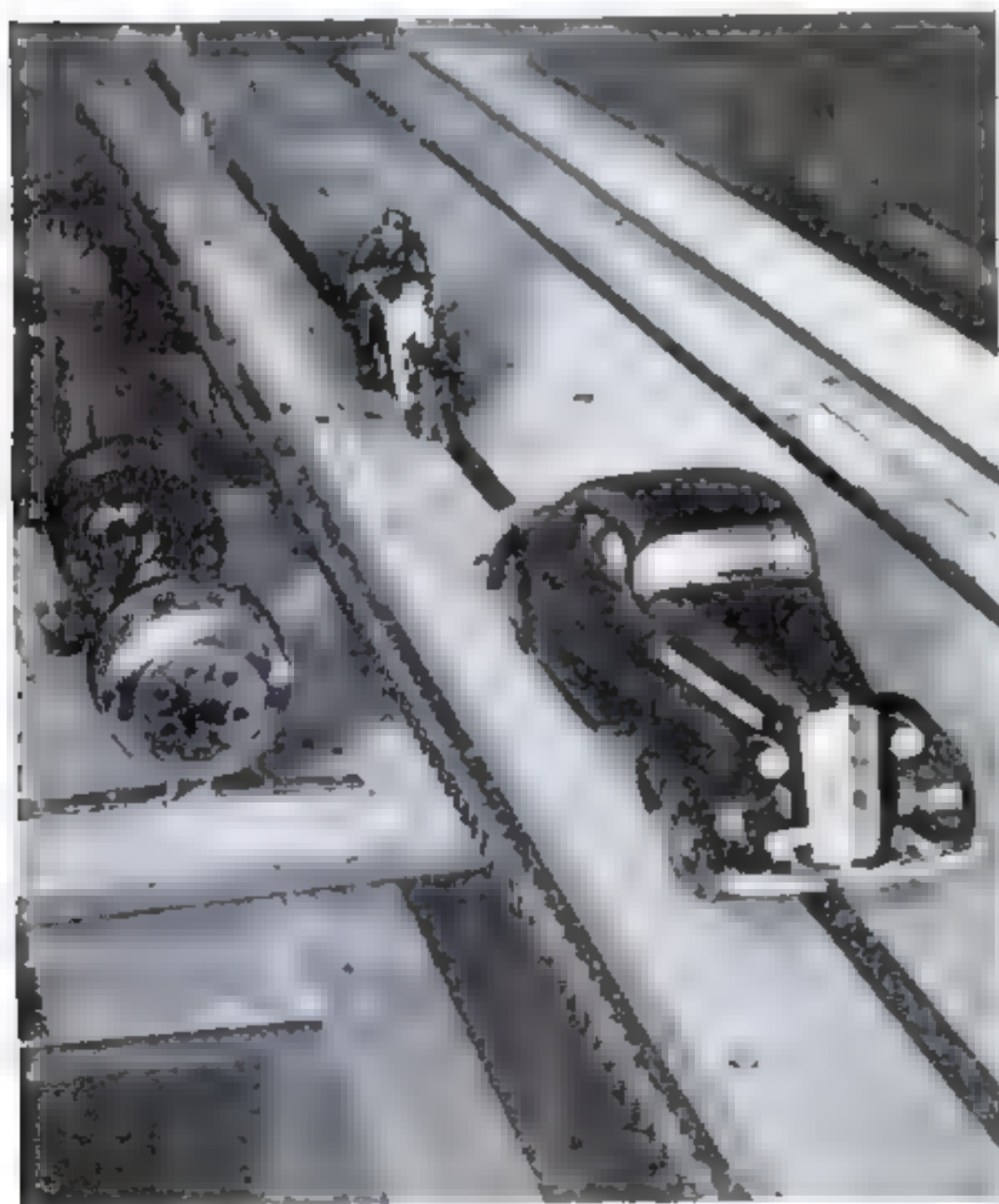
COMES TO LIFE

HOUSES, FENCES, AND SERVICE STATION BUILT IN PERSPECTIVE TO GIVE EFFECT OF DEPTH

AUTOMATIC PROJECTOR THROWS MOTION PICTURE ON SKY AT REAR OF MODEL



Mechanical features of the display, showing the system of belt drives for actuating the moving vehicles



For a human touch, a motor-cycle policeman pursues a speeder along the highway while a siren sounds. A concealed third wheel supports the motor cycle

The scale at the right shows sizes of the trees according to their apparent distance from the eye. Below, a section of rustic fence, showing how it tapers away into the distance to produce a realistic depth effect





Photograph Shows Diver as "Diana"

SOARING out from a springboard while holding a drawn bow, Ruth Jump, appropriately named diving champion, seems to be suspended motionless in mid-air in the striking photograph reproduced at the left. The unusual camera shot was snapped at the Olympic swimming pool in Los Angeles, Calif., during a practice session before a recent aquatic exhibition.

In this remarkable photograph, Ruth Jump, novelty diver, appears to be posing for a statue of a Greek goddess

Children Make 'Chute Jumps from Midget Russian Tower

CHILDREN now make parachute jumps in a Moscow park from a diminutive counterpart of the large parachute towers long popular with Russian adults. Climbing a stairway, the youngsters are securely strapped into the 'chute harness by an instructor, and then "bail out" by sliding down a steep wooden ramp for a fourteen-foot descent to the ground.



Russian children enjoying the thrill of parachute jumping from a miniature tower in a public park in Moscow



This blue jay was caught red-handed

Camera Trap Catches Bird Thief in Act

HOUSEHOLDERS in Seattle, Wash., annoyed by thefts of the cream from milk delivered to their doorsteps, located the culprit when Kenneth Short, a local amateur photographer, devised a novel camera trap. Drilling a hole in the bottom of a bottle, Short ran a wire up through the milk to the cap, and fastened the other end to the shutter release of his camera. The result was the curious photograph at the left, showing a blue jay in the act of lifting the bottle cap.

Novel Metal Snips Cut Odd Shapes

SQUARES, circles, half-moons, and other designs are easily cut out of sheet metal of average thickness with novel snips that pivot as they cut. When in use, the cutting blades of the new tool operate in a horizontal instead of the conventional vertical position, allowing the metal worker to guide them around corners to make any desired angle or curve required by the work in hand.



These odd metal shears have horizontal blades

Air Pressure Runs Tiny Vacuum Cleaner



Tiny vacuum cleaner attached to filling station air line... service to customers.

COMPRESSED AIR operates a small vacuum cleaner recently introduced for use at gasoline filling stations in cleaning the upholstery and floor mats of automobiles. Simply constructed, and with no moving parts, the cleaner is attached to the air-pressure tire hose so that attendants can quickly dust out car interiors as an added service to customers.



Bird Doctor Operates Clinic for Canaries

DOZENS of feathered patients are treated daily at a Houston, Tex., clinic where Marjory Shear, bird physician and surgeon, relieves the ailments of household pets. Before performing an operation, she administers a drop of anesthetic with a medicine dropper, as shown in the photograph above. Apparatus at the hospital includes oxygen tanks for birds with pneumonia.



The drummer rides "no-hands" to ply his two drumsticks

Miniature Battlefield Trains War Flyers

A pilot of the Royal Air Force watching a "battle" on the animated model of no man's land

Below, an electric smoke pot supplies puffs to simulate the bursting shells



TROOPS, tanks, and guns move realistically across a miniature battlefield, while puffs of smoke simulate the bursting of shells and bombs, in an animated model used to train British flyers in cooperating with ground forces. By means of electromagnets that control the movements of opposed units, any desired tactical situation may be presented upon the battlefield



Mirrors on a trestle give a view of the road beyond the hilltop

"Trafficscope" Aids Motorists

MOTORISTS can see what is coming toward them beyond the top of a hill, with the aid of a "trafficcope" devised by a Minnesota inventor. Mirrors placed upon a highway bridge, as in the trial installation illustrated, serve as periscopes to reflect a view of oncoming cars in each direction from the hilltop.

Army Bandsmen Play While Riding Bicycles



Members of this Dutch military band are trained to pedal bicycles and play at the same time

BLARING martial airs as they pedal along, members of an army band in Holland successfully handle their instruments and their bicycles at the same time. Their bugaboo is a flat tire,

which would throw the musicians into discord and confusion. To prevent such a catastrophe, a careful tire inspection precedes every performance of the unique musical organization.

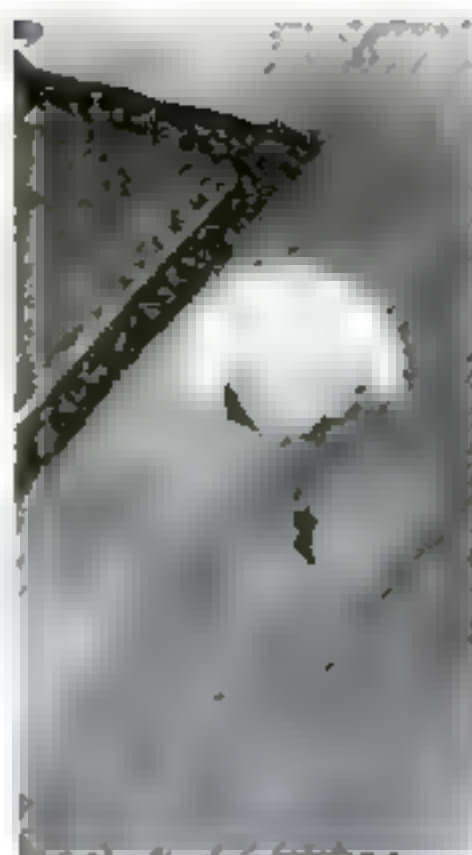


Giant Scale Checks Beauties in Contest

BATHING BEAUTIES who recently competed for the title of "Miss California" weighed in on a novel wooden scale set up on the sands of a popular beach resort, as shown in the photograph. As one of the requirements of the competition,

contestants checked their weight on the scale against that of Miss Mitzi Uehlein of Venice, Calif., who had previously been selected as an ideal standard for comparing the qualifications of other young women in the beauty contest.

Parachute Jumper Shaves While in Mid-Air



LEAPING from a plane at an altitude of 12,000 feet, Harold Parkhurst, New York parachute jumper, gave himself his morning shave as he floated down to earth. Parkhurst used an electric razor that was powered by a dry-cell battery carried in the pocket of his flying suit. The novel stunt was performed above a Long Island airport.

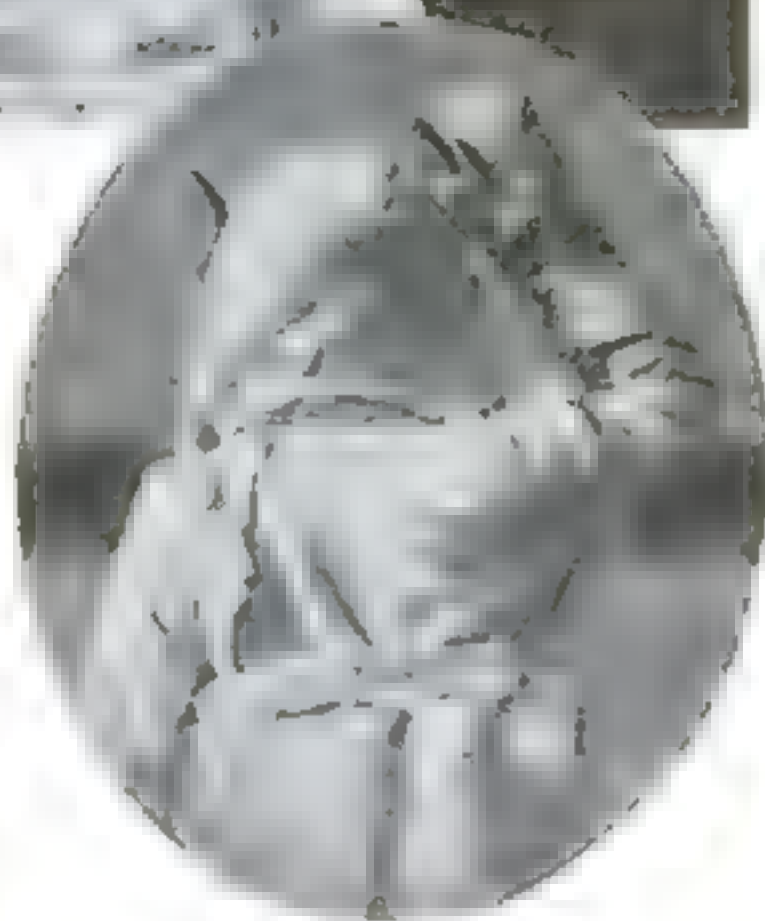


"That was a close shave," Harold Parkhurst is saying



"Rabbit Suits" Aid Rescuers In Plane Fires

DESIGNED for rescuing flyers from burning planes, new-type asbestos suits worn by members of the ground crew at a French flying field are topped by grotesque helmets with rabbit-like ears. Metal side vents in the helmet allow for hearing and breathing, but in an emergency the wearer closes the vents, pulls the ears down over them, and dashes into the flames. At the front of the helmet, panes of heat-resisting glass inclose blue-tinted water that gives clear vision in the glare of flames.

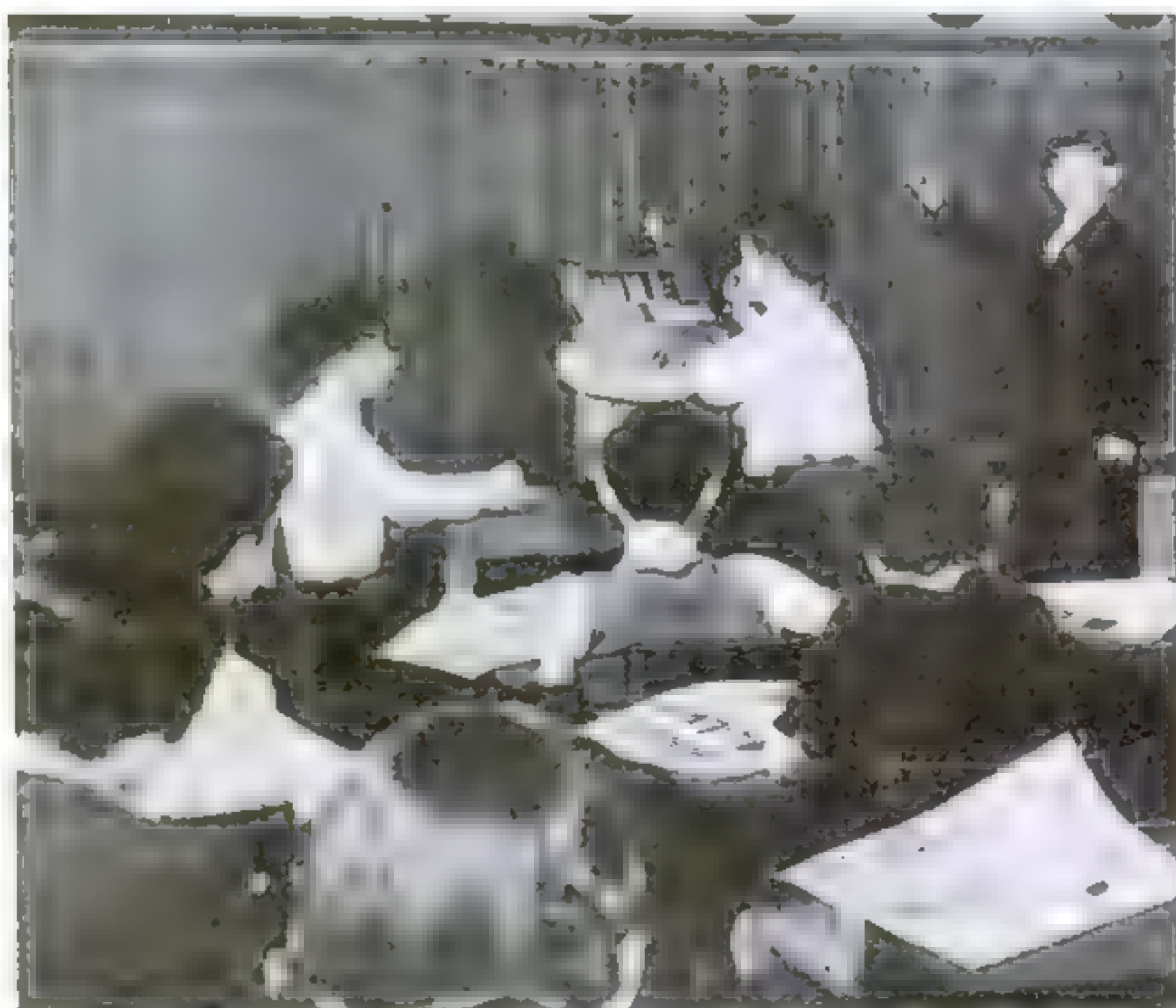


Front and rear views of odd rescue suit for airport ground crew

Students Try "Luck" on Slot Machine

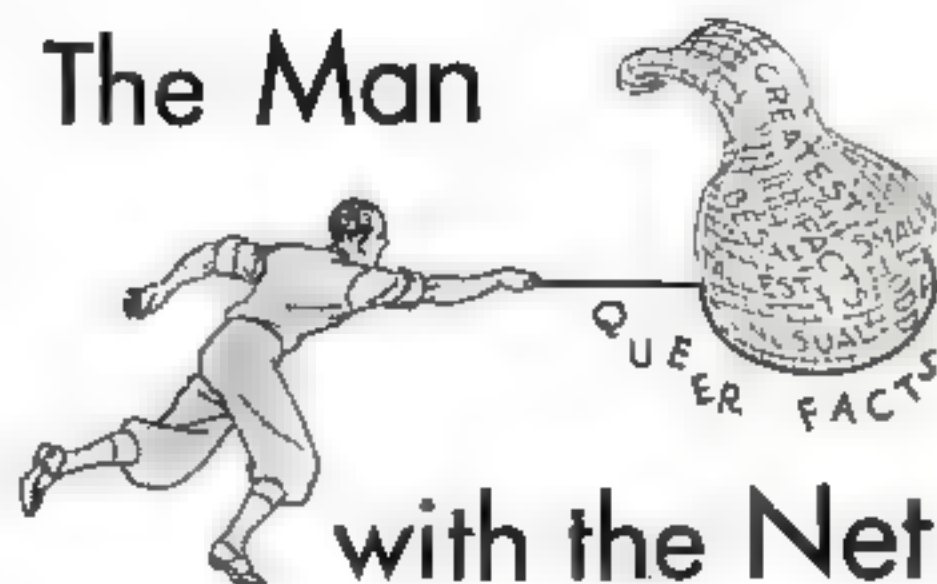
A SLOT-MACHINE gambling device was set up recently in a Riverside, Ill., schoolroom to enable the pupils to discover for themselves that the machine always wins. On the blackboard, the students kept records of the number of plays and the amount

"won" on each, to prove that, in the long run, players are mathematically certain to lose. The unusual demonstration was arranged by the school principal with the consent and endorsement of local parents and school teachers.



Students operating a gambling machine to prove that the device always wins

The Man

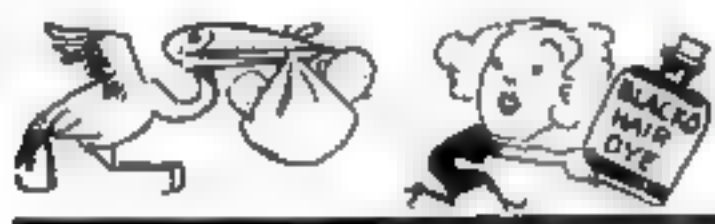


with the Net

NEW ZEALAND has more cows than humans.

ONE THIRD of all the radio beacons in the world are in the United States.

BLONDES have twins oftener than brunettes.



INHABITANTS of the mining village of Ollagüe, in Chile, live at an elevation 1,700 feet higher than the tip of Mount Blanc. It is probably the highest permanent settlement in the world.

LAKE TROUT have weighed as much as 123 pounds.

ANTHRAX MICROBES are the largest germs known.

HUMAN TEETH sometimes are literally as hard as steel.



CHANGES in barometric pressure have run a Swedish clock for twenty years.

EGYPTIAN chariots are antedated by a 5,000-year-old dog sledge recently unearthed in Finland, called man's earliest known vehicle.

WITNESSES in criminal trials have only thirteen chances out of 100 of identifying an unfamiliar voice correctly after a lapse of five months, according to Johns Hopkins University psychologists who have tried it.



ARTIFICIAL PUMICE has been produced in a German laboratory.

A SUBMARINE for torpedoing crocodiles was recently requested by King Yeta III, of Barotseland, in England's colony of Northern Rhodesia.



Safety Helmets Protect Baseball Players



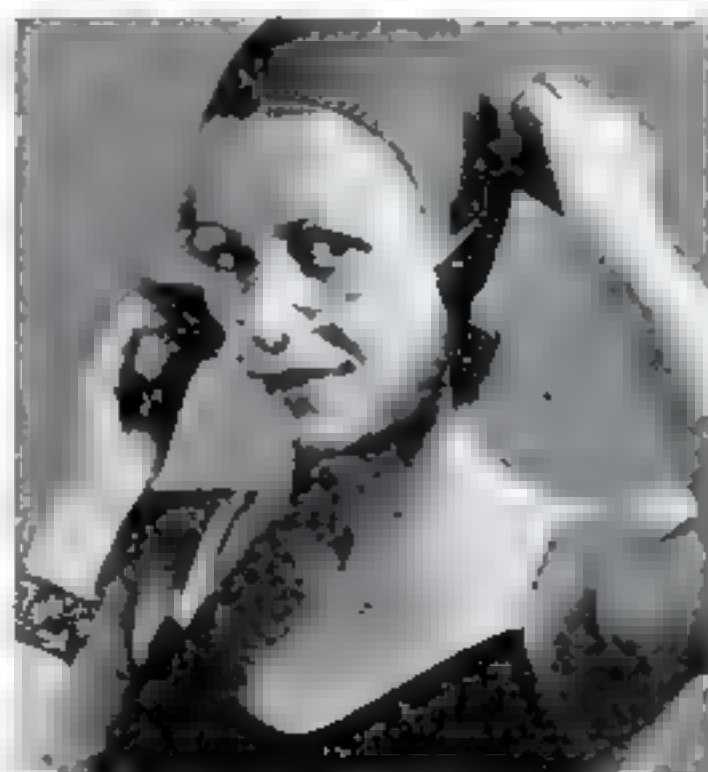
A player tries out one of the helmets during batting practice

HELMETS of the type worn by polo players are being tried out by baseball teams as a protection for batters. Donned in place of the regulation cloth cap when a player comes to bat, the hat safeguards his head from possible injury by "bean balls" or close pitches he is unable to avoid. In the photograph, Wally Moses, of the Philadelphia American-League team, is seen trying out the novel head cover.

Living Air Plants Decorate Women's Summer Hats

LIVE plants are now being used as decorations on women's summer hats. The novel millinery embellishments are epiphytes, or air plants, which, like orchids and lichens, derive their nourishment solely from air and moisture. Growing wild in great profusion in Florida, the plants will thrive when sewn to the crown of a hat and fed periodic rations of water.

How a medicine dropper is used to water the living hat decoration

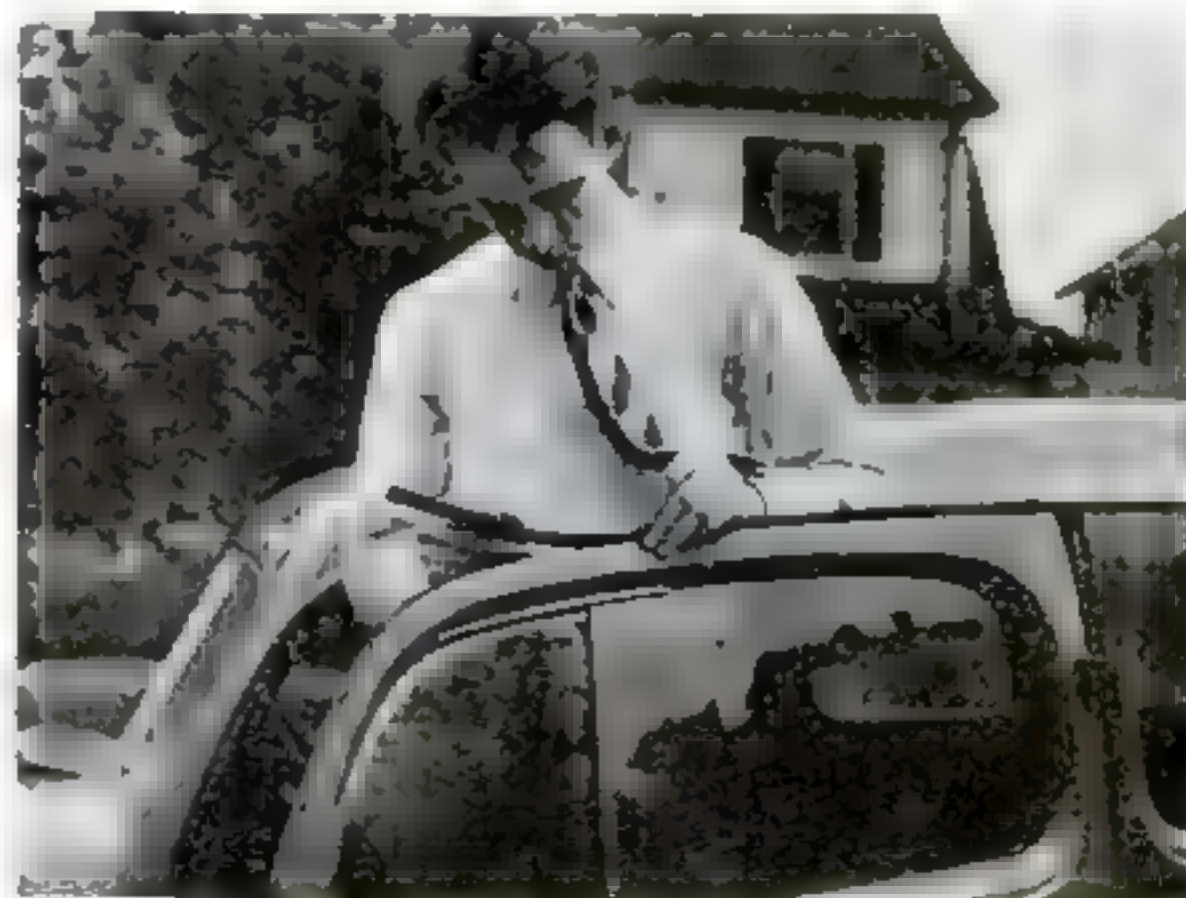


Clip Keeps Water from Bather's Nose

A NOSE CLIP for swimmers is said to aid in preventing deafness, sinus trouble, and other ailments sometimes caused by water entering the nasal passages. Consisting of a rubber-covered metal arch, the device forces the wearer to breathe through his mouth.

Gutter Strip for Car Door

NOVEL rain gutters made of molded rubber fit over the tops of automobile doors to prevent water from dripping into the car interior. Quickly installed by stretching them along the door top, the accessories form a drain to carry off water from the car roof. The gutters can be sprayed or painted to match the body color and make them inconspicuous.



The rubber channel is stretched along the door top

ONE-MAN Inventions ARE RARE

By
Aubrey D. McFadyen

AN ELECTRIC lamp bulb that gives ten percent more light, at no extra cost, has just been announced by General Electric research workers. Just one small innovation—a new way of coiling the filament—distinguishes it from previous types. Yet engineers hail its development as the most important advance in incandescent electric lighting since the introduction of gas-filled bulbs in 1913.

Little improvements make great inventions. Thomas A. Edison once remarked that his work consisted largely in perfecting the work of other inventors. He didn't make the first incandescent electric light. He gets the lion's share of the credit for its invention, and rightly, because he produced the first that burned well enough to be a commercial success. Inventors of a later day have continued to improve upon his ideas, just as Edison improved upon the ideas of his predecessors.

Take a little exploring trip through the fascinating files of the U. S. Patent Office, in Washington, D. C., and you may imagine that there is nothing new under the sun. Electric clocks, you discover, date back to 1853, and streamline trains almost to Civil War days! Air conditioning systems, safety glass, the slide fastener, and any number of other



THE ELECTRIC
LIGHT

Edison didn't make the first electric lamp. And it is a far cry from the old carbon-filament bulb above, and the early types pictured at the right, to the efficient lamps of today



Latest type of filament, at right, contrasted with the kind now commonly in use

things we think of as "new," prove to have almost as early beginnings. And it took more than one man to bring each of them to perfection.

How valuable inventions may languish for generations, until some inventor comes forward and removes the final obstacle that blocks the way to

commercial use, is shown by the case of the slide fastener. The idea of a multiple-toothed clasp, opened by pulling a slide one way and closed by drawing the slide the other way, made its debut as early as 1893 in the form of patent No. 504,038 granted to Whitcomb L. Judson of Chicago, Ill. Judson

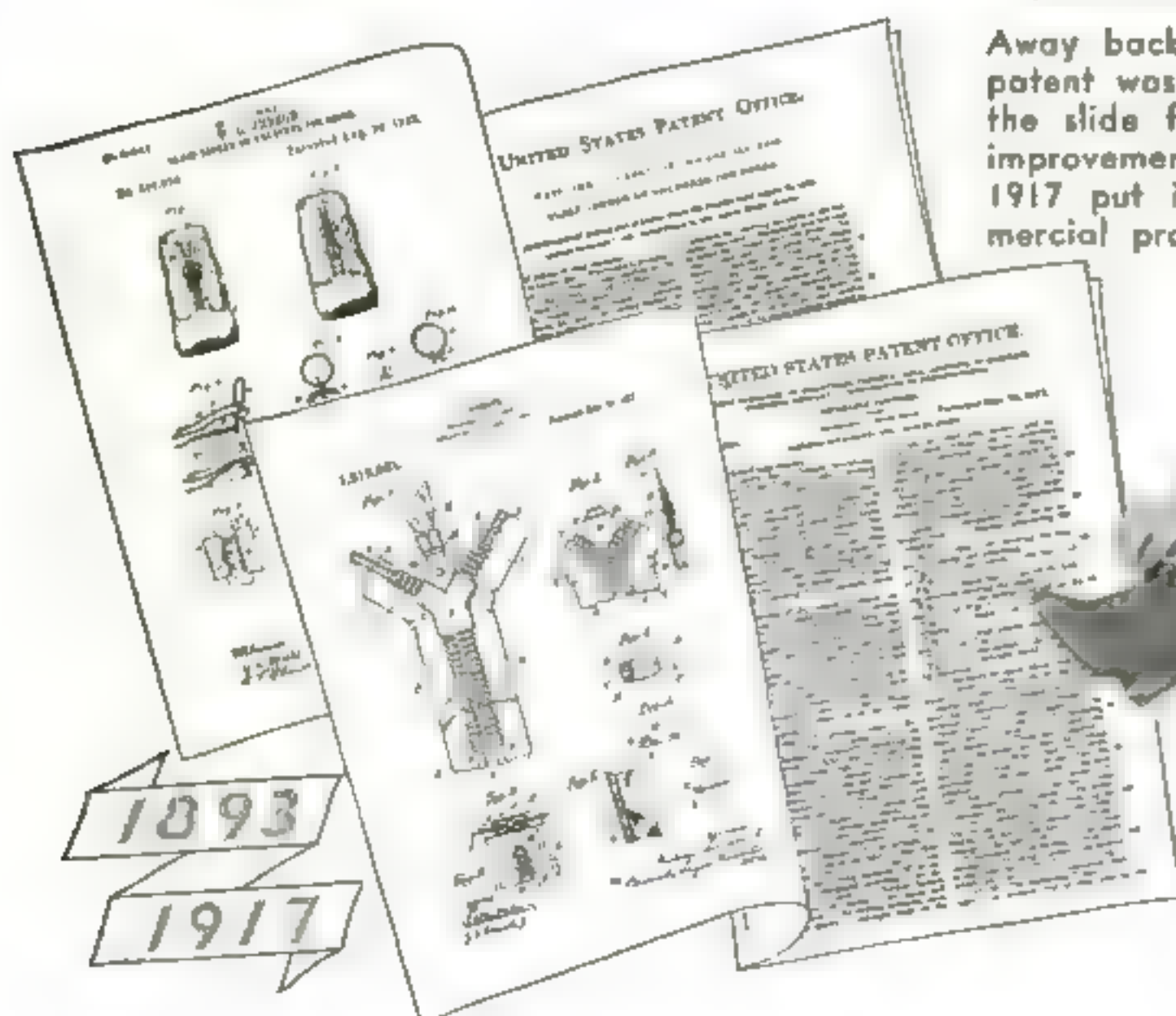
called his invention a "clasp locker or unlocker." "My fastener," he stated, "is especially designed to take the place of shoe laces, but may also be applied to mail bags, belts, and the closing of seams uniting flexible bodies."

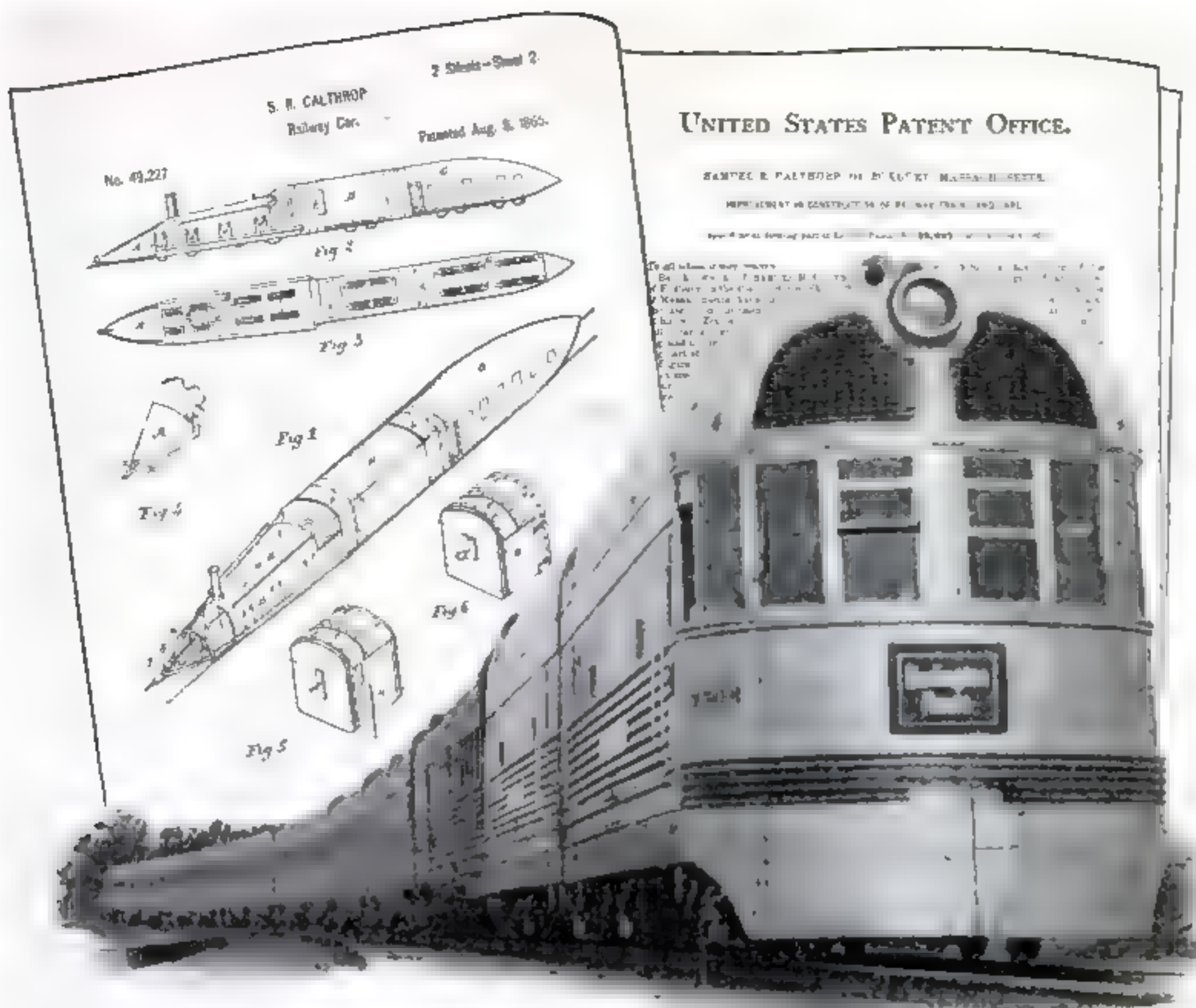
Judson missed inventing a practical slide fastener only by a hair. Each tooth of his invention required three right-angle bends, so complicating its manufacture that it could not be produced economically.

Look at the modern fastener and notice how simply the ends of the teeth are headed. This was the final step, worked out nearly twenty-five years after Judson's patent by Gideon Sundback of Meadville, Pa. At last the fastener came into its own for clothing, luggage, and a

SLIDE FASTENERS

Away back in 1893, a patent was granted on the slide fastener. An improvement made in 1917 put it into commercial production





STREAMLINE TRAINS AREN'T NEW

The Civil War was barely over when Samuel R. Calthrop received a patent on a streamline train. Diesel engines and lightweight alloys have now made his dream come true

variety of uses seemingly without limit—as when a surgeon recently attached a slide with adhesive tape to the abdomen of a cancer patient, so that an incision in his stomach could be opened easily for daily treatments! Produced in sizes from a few inches to fourteen feet in length, modern fasteners stem from an invention that missed adoption years earlier simply because the original inventor omitted to perfect one small detail.

Sometimes, completion and acceptance of an invention must await an improvement in a wholly foreign field. Because of the prohibitive weight of steam engines, airplanes couldn't fly until inventors supplied the gasoline motor. Similarly, delay in the introduction of the electric clock was due to a shortcoming at the power plant.

Electric clocks of various types were patented as early as 1853. The present type, using a "synchronous" motor that revolves in time with electrical pulsations coming over the wire, was tried out in Cologne, Germany, as far back as 1895. It was extensively publicized in this country the following year. For well over thirty years, the electric clock awaited its market. The obstacle to its adoption was simply that the power companies hadn't learned how to keep their current pulsing at a uniform rate, enabling the clock to tell accurate time. Only in recent years have they been able to do this. As for the electric clock itself, the only important mechanical change since 1895 has been the addition of the self-starting mechanism found in some models.

The streamline trains that streak across the continent today were born more than seventy years ago. To be exact, it was on August 8, 1865, that

Samuel R. Calthrop of Roxbury, Mass., received U. S. patent No. 49,227 giving him the exclusive right for seventeen years to "make, use, or sell" a streamline train. Calthrop treated the entire train, in his design, as an aerial ship. The nose or "prow" of his locomotive was shaped "like a shark's head" because the inventor found this contour offered least air resistance, both in moving forward and in turning curves. The rest of the train, which he called the "stern," was streamlined in the approved manner of today. Flexible hoods bridged the gaps between cars, thus eliminating air pockets. All windows were flush with car walls. The bottom as well as the top of his train was streamlined.

Modern streamliners do not depart

SHATTERPROOF GLASS

The safety glass used on modern cars comes from an idea patented in 1906



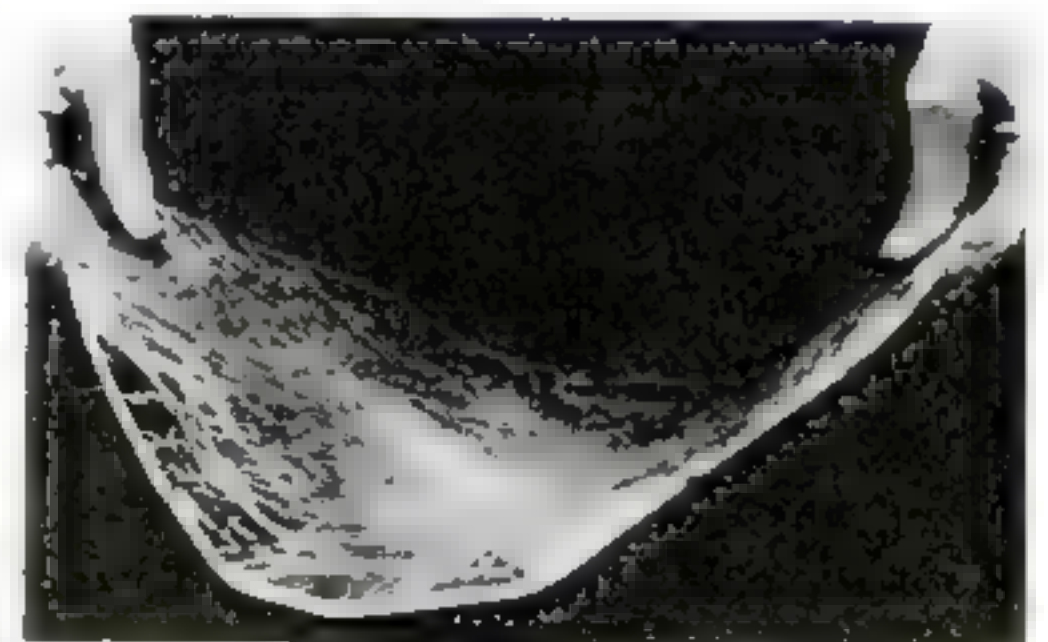
from the principles that Calthrop laid down three quarters of a century ago—in fact, the only real difference is that few, if any, present-day trains are streamlined as thoroughly! Calthrop wasn't to blame if his idea didn't take on at once. It took lightweight, airship-type alloys and Diesel motors to make high operating speeds economical for railroad trains, and bring out the advantages of streamlining.

Safety or shatterproof glass for automobiles provides another example of an invention that preceded the demand for it. This material, consisting of two exterior sheets of glass and an inner transparent sheet of celluloid cementing them together, was patented in the United States away back in 1906. The inventor, John Crewe Wood of Swindon, England, stated in his patent application that his invention was devised "to prevent injury to the occupants of motor cars through pieces of glass striking them, if by accident the windows be broken, the pieces of broken glass adhering to the interposed celluloid and not becoming detached." Present-day production figures for safety glass show his idea was a splendid one. Why didn't it take on at once?

One simple fact provides ample reason. At the time of Wood's invention, and for years following, open cars predominated upon the road. It was not until 1925 that closed cars, for the first time, took the lead in sales. Today more than ninety-nine percent of all new automobiles are closed models, and safety glass has enjoyed a corresponding boom.

Even when the demand arose for safety glass, however, other inventors had to supply a detail that Wood had omitted to perfect—a transparent cement that would not become discolored, and that would make a secure bond with glass. A synthetic resin with the needed properties was finally produced by Carleton Ellis, noted chemist of Montclair, N. J.

In this cycle of one inventor improving upon the *(Continued on page 118)*



Trotters coming around the turn into the homestretch in a race at a county fair in California



MAKING CHAMPIONS in Harness-Horse Racing

AS THESE words are written, trained trotters and pacers are taking to the road. Billboards are announcing the initial races of the harness-horse season. Workmen are grading and smoothing dirt ovals. Trainers are putting the finishing touches on thoroughbreds for competition at county fairs, on the Grand Circuit, and at the larger meets. Last year, nearly 20,000 horses competed in more than 700 meetings for prizes that totaled \$5,000,000. The sport of horse-and-buggy days has returned to favor.

During the next few months, hundreds of thousands of spectators, in all parts of the United States, will cheer themselves hoarse as drivers, riding featherweight sulkies, jockey into the turns and urge on their horses in neck-and-neck finishes on the straightaway. Only a small percent of them, however, will know the story of careful, scientific training which lies behind the track accomplishments of the thoroughbreds.

Day after day, for months and years, experts have been perfecting the racing form of the different horses. With a hundred and one mechanical aids, they have defeated nature to develop gaits that win. In fact, the improved equipment which experimenters have placed at the disposal of trainers and drivers—the scientifically designed sulkies, the balloon tires, the faster tracks, the improved harnesses and shoes, the ingenious protective devices—are given a large share of the credit for reviving

interest in this exciting, old-time sport.

Last year, during the Grand Circuit races at Toledo, O., night events on a lighted track were a feature of the meeting. The innovation proved highly popular. Thousands of people flocked out in the cool of the evening to witness the spectacle. There was little

wind at that time of day, and the better atmosphere enabled the horses to run faster. The idea promises to spread during the present season.

Usually, a harness horse is two years old before it begins its racing career. By the time it is seven, it is slowing down and its days on the track are drawing to a close. A celebrated exception to this rule was Goldsmith Maid, the queen of the trotters in the 1860's and 70's. She was unbroken until she was six years old, and she equaled

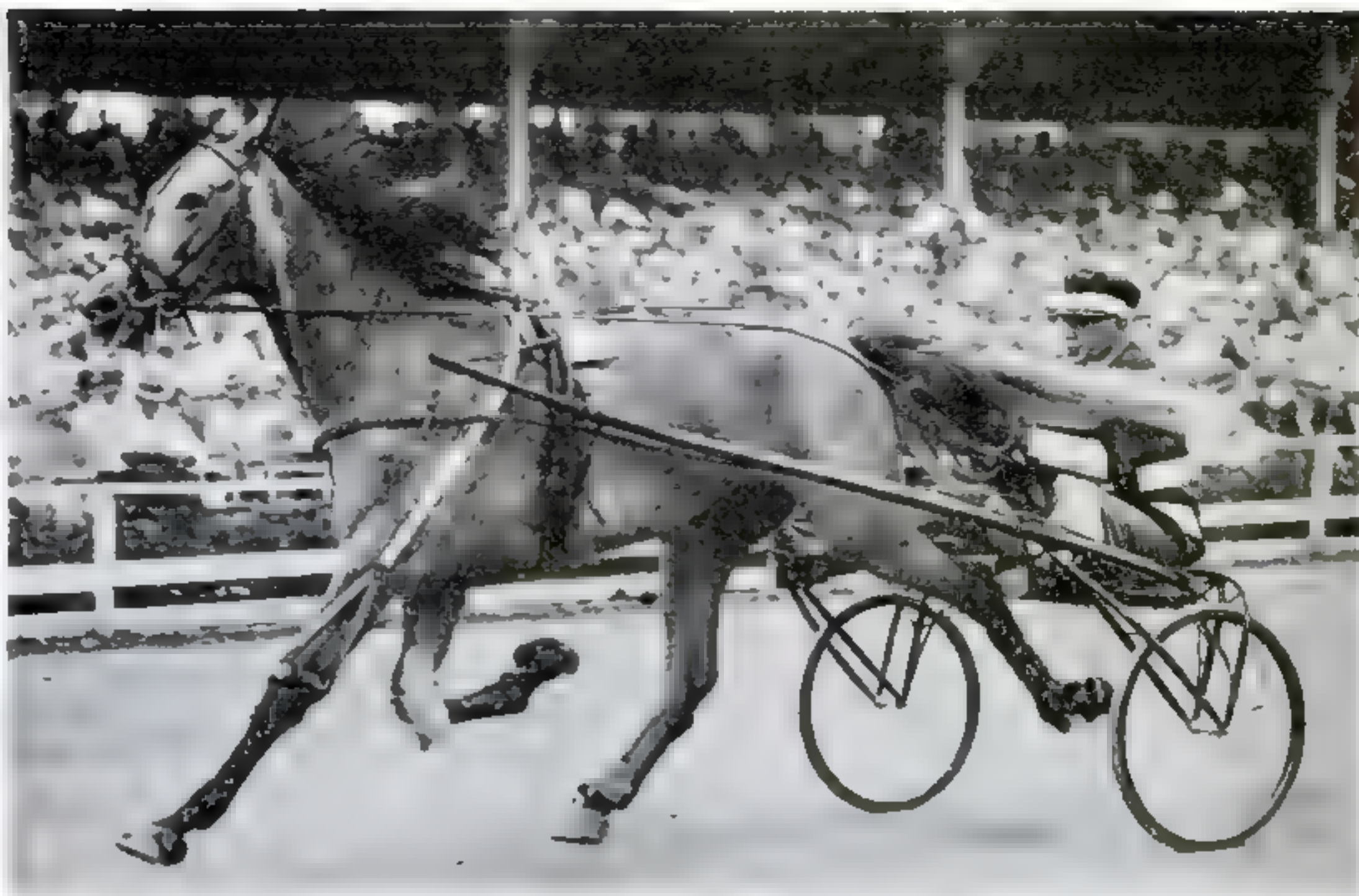
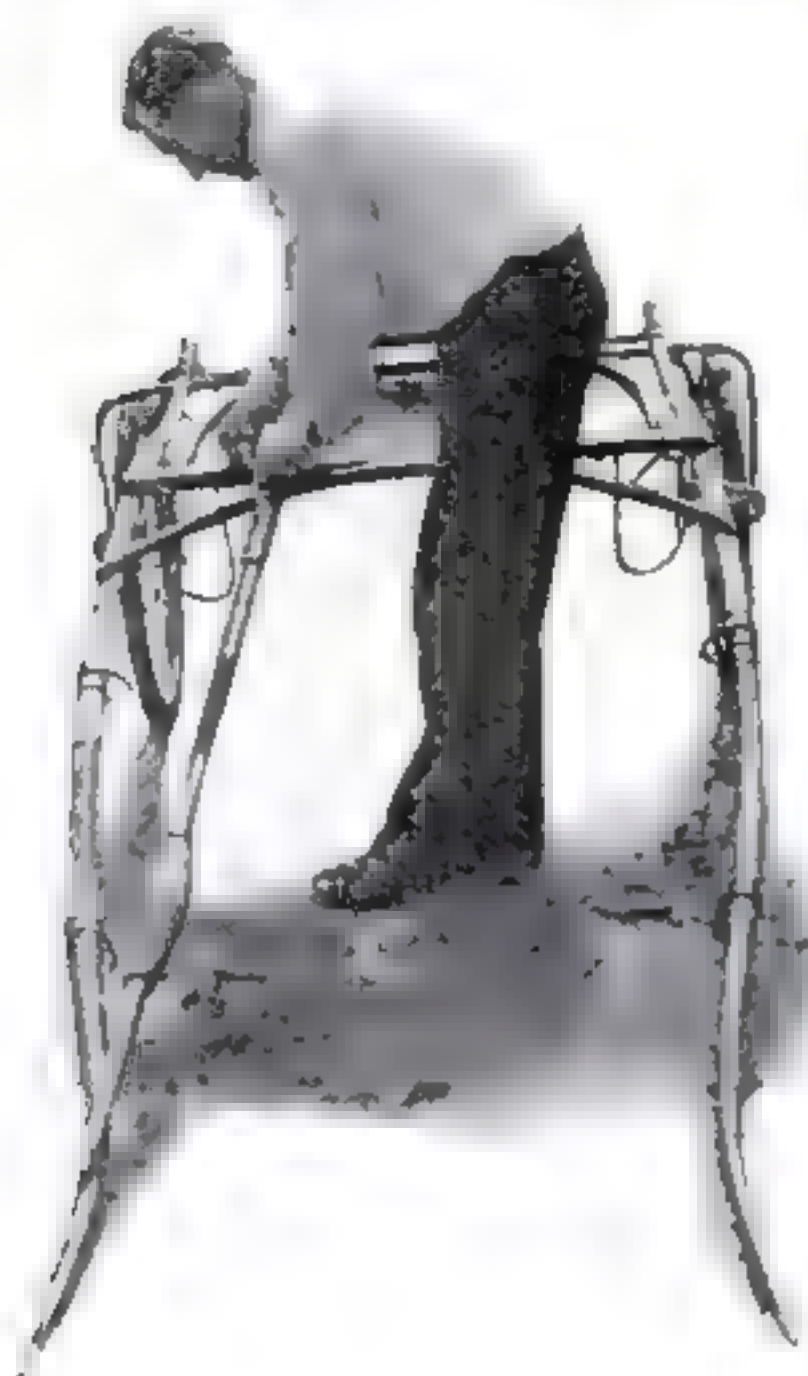


HARNESS GAITS
Padded hobbles keep pacers from running. At the right, the left-hand horse is pacing, the other trotting

By JOHN E. LODGE



To break a horse of the habit of running sidewise, a side pole is fastened to one of the sulky's shafts



A trotter wearing hobbles, knee pads, and other devices that help in teaching the horse to hold a gait, and protect it from injury. Mechanical aids play a large part in the arduous training that makes a winner

the time of her fastest mile when she was nineteen! During her thirteen years on the track, she won 350 out of the 426 heats she entered, and the total of her winnings remained a world's record for more than half a century. A monument has been placed over her grave near Trenton, N.J.

Harness-horse racing dates back to 1845. During the last decades of the Nineteenth Century, almost every American village had its trotters, and races were a feature of most Fourth of July programs. Now, the best horses come from large stables and breeding farms where specialists develop the ability of the animals by a long course of intensive training.

Two types of horses—trotters and pacers—are used in harness racing. Their names come from the characteristic gait they use. The natural gait for a horse going at full speed is a run or gallop. Both front feet and both rear feet move together. In trotting, how-

ever, the forefoot on one side and the rear foot on the other move in unison. In pacing, or "side-wheeling," the two feet on the same side move together.

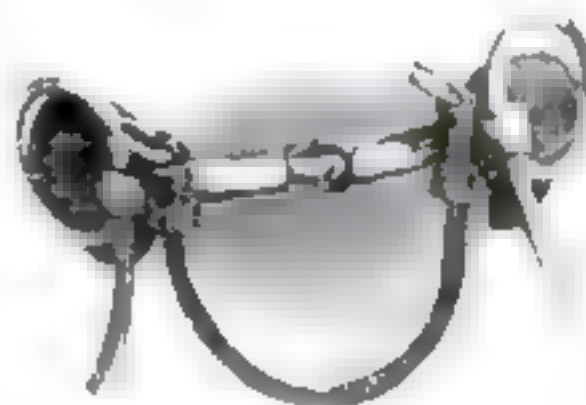
A few animals are double-gaited. They can either pace or trot. One of the greatest of these versatile horses is the black mare, Calumet Evelyn. At Lexington, Ky., she once paced two different miles in 1:59. Four days later, she entered a race as a trotter and led the field to a 2:02 victory.

Both trotting and pacing are artificial gaits produced by breeding and training. The best harness horses, however, can cover a mile faster with their acquired gaits than they can at a full gallop. In the excitement of a close race, young animals sometimes break into a run and so lose their chances of winning. A horse that breaks its gait while leading down the home stretch is said to "jump it off."

The work of developing a champion

begins early. When the colt is only a few months old, a leather-covered "humane" bit is placed in its mouth and left there for several hours a day. Later, when the mouth has been toughened, a

regulation steel bit is used. The second step is to leave a harness on the colt for a certain period each day while it is in its stall. Then comes teaching it to respond to reins. Two boys, holding long straps, walk on either side of the animal to keep it from getting out of control, while the trainer follows behind



A leather-padded bit for "breaking" colts

and guides it with reins. In two or three weeks, the average colt is ready for the training cart.

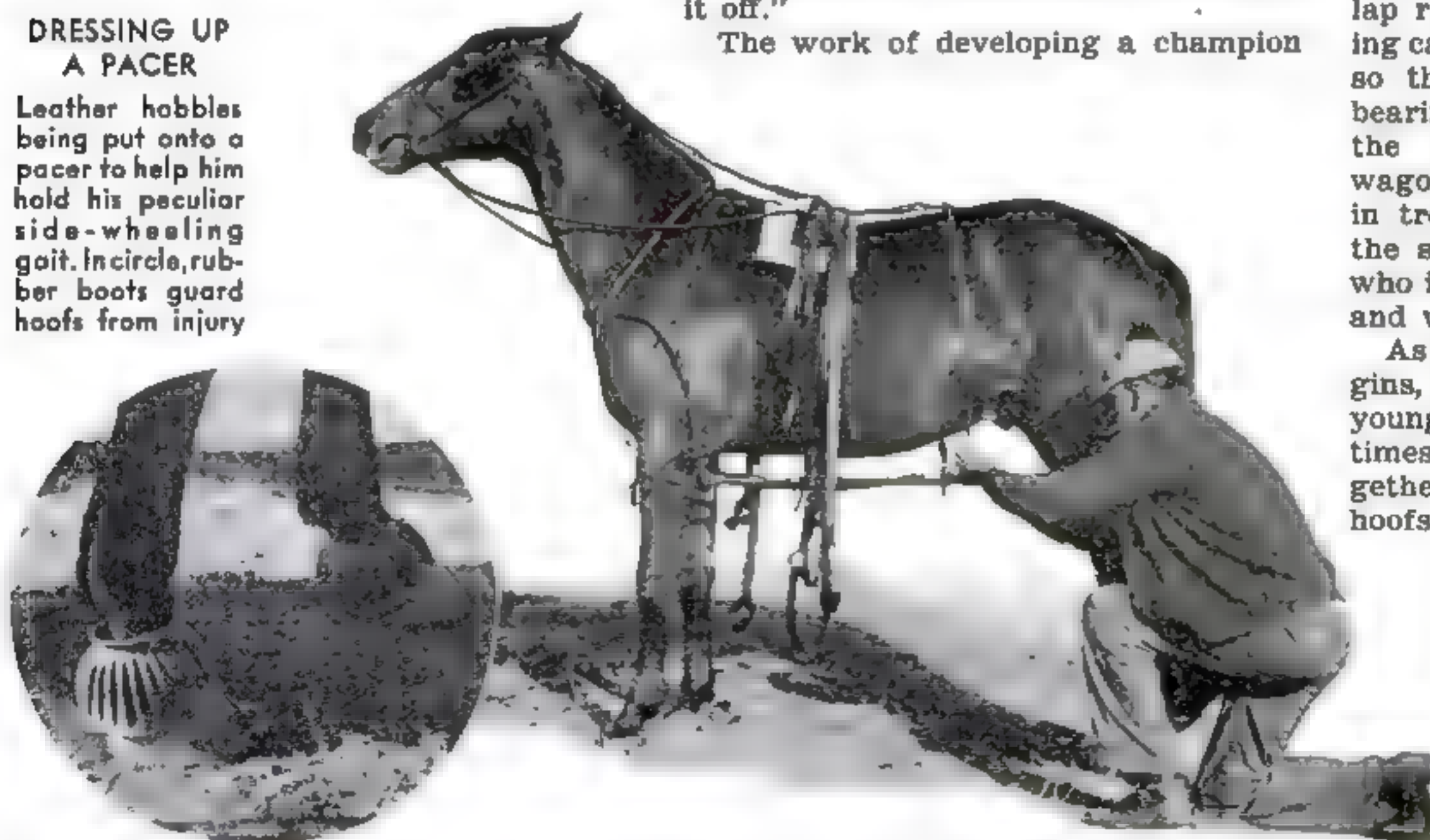
This is a sturdy, sixty-five-pound sulky designed to stand hard usage. In actual competition, a \$225, thirty-pound racing sulky is used. For winter work, a jogging cart with wooden wheels and a bucket seat that permits the use of lap robes, is substituted for the training cart. All these vehicles are designed so the shafts lift slightly instead of bearing down on the pulling horse. In the early days, light, four-wheeled wagons, carrying two men, were used in trotting races. Legend has it that the sulky got its name from a driver who introduced it because he was sulky and wanted to ride alone.

As soon as actual track practice begins, faults in the footwork of the young trotter or pacer show up. Oftentimes, the animals hit their knees together or strike their legs with their hoofs. Leg guards, knee pads, boots, and other equipment protect them during this period of their training and prevent serious injuries.

Special hobbles help the animals to keep their gaits during the early stages of their development. Small weights, running from two to five ounces,

DRESSING UP A PACER

Leather hobbles being put onto a pacer to help him hold his peculiar side-wheeling gait. In circle, rubber boots guard hoofs from injury



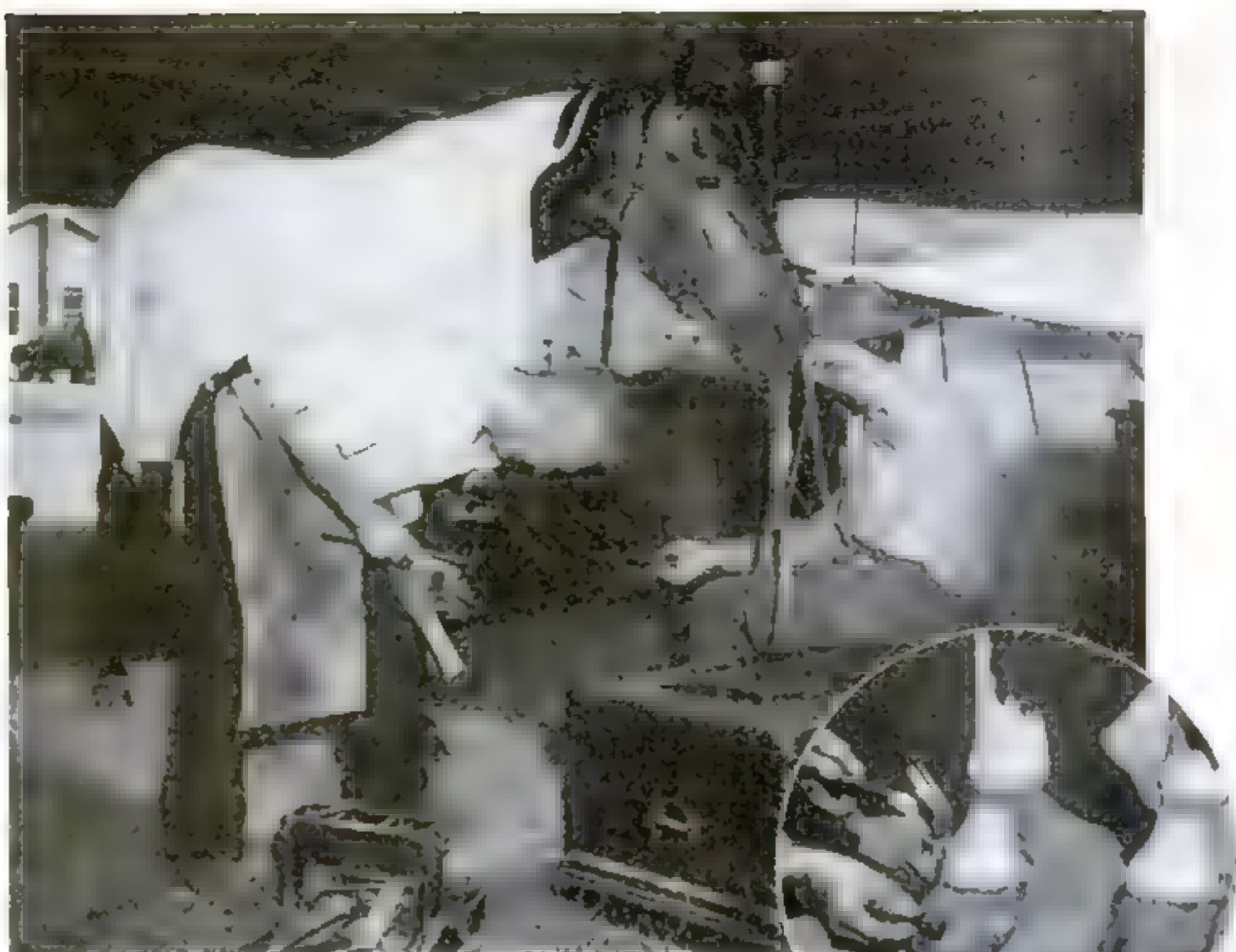
are attached to the fore hoofs to balance up the feet and increase the length of the stride. Heavier shoes also are worn on the front feet. Grooves are sometimes placed in the shoes to aid the animals to grip the track, and some horses are shod with the steel placed over sponge-rubber pads that lessen the jar. The specialist who shoes a racing horse measures the length of the hoof with calipers before he begins work. Some horses require long toes to grip the track, others short ones to prevent tripping. Each animal has its own peculiarities in handling its feet, and these are studied continually by the trainers.

A few horses never are cured of their defects. It was a horse of this kind, a brilliantly fast trotter with the dangerous habit of crossing its legs when rounding a turn, that brought death to Edward F. ("Pop") Geers, the greatest driver in trotting history. For fifty years, this veteran of the track averaged 100 races a season. He was one of the first to use the lightweight bicycle sulky and invented the strategy of letting another horse break the wind during the first part of a race. His innovations are given credit for clipping ten seconds from the trotting record for the mile.

He was seventy-three years old when he started in a race against time at the Wheeling, W.Va., track. Coming out of the back stretch, the excited horse crossed its forelegs, tripped, and catapulted the sulky over its head, hurling Geers to death.

Frequently, ropes of sheepskin, called shadow rolls, are placed across the nose of the horse to prevent its looking down at the track directly in front of it. High-strung racing animals sometimes try to jump over shadows or dark spots when they are running without the rolls. At the Goshen, N.Y., track, Bert Yetten was seriously injured when a pacer, competing without this equipment, tried to jump over a wet spot and tripped. Yetten was leading the field at the time and all the other contestants piled up in a struggling mass on top of him.

The elevation of the head also is watched carefully during training. Most horses have their checkreins adjusted so their heads are well up. Calumet Denver, a noted trotter sold to Sweden for breeding purposes, always ran with



A scene in the traveling blacksmith shop at the Goshen, N.Y., track. At right, weights being attached to a trotter's front hoofs to balance them and lengthen the stride

his head very high. If he got it down, he lost speed immediately. In contrast, there was *Invader*, a world's champion three-year-old who took second in the Hambletonian Stakes in 1932. He always made his best time when his head was low, stretched out almost straight in front of him.

To break a horse of the habit of running with its head turned to one side, a piece of billiard cue is attached to the bridle so it holds the head from turning. Again, when horses get the habit of running with the body slightly sidewise instead of parallel to the direction of travel, a side pole is fastened to the sulky shaft so it rubs against the animal if it gets out of line. Some of these poles are equipped with rollers to prevent injury to the animal's skin.

Individual horses use their tails differently during a race. Many drivers wind a length of bandage around the tail and sit on the end of the cloth strip to keep the hairs from striking them in

the face. In the case of *Linda Hanover*, this was always impossible. Unless her tail was free, she couldn't run. As soon as she was making top speed, her tail would start going around and around like a propeller.

For a young horse in training, work begins about nine o'clock in the morning, after a *(Continued on page 123)*



A SHADOW MIGHT LOSE A RACE

This horse is wearing a shadow roll, designed to keep it from seeing shadows or dark spots on the track surface that might tempt it to jump and break its gait. In the picture at the left, one of the horses is using such a ring and has weighted hoofs



An ALPHABET of Safety

By BERTON BRALEY

A is for ACCIDENTS, which, be apprised,
You will avoid if you're aptly advised.

B is for BRAKES and for BUMPERS; neglect
Care of the former, the latter gets wrecked.

C is for CAREFULNESS, CALM, and CONTROL
Ceaselessly practiced wherever you roll.

D is DECISION, your lack of which serves
To rasp other motorists' tempers and nerves.

E's for EMERGENCIES, which, we would hint to
You to get out of—by not getting into!

F is for FACTS—let us quote you a case—
Two cars cannot—safely—command the same space.

G is for GUESSING that you can get by.
(Also for GRAVEYARDS where bad GUESSERS lie.)

H is for HORN and the HOOTING it makes
(Which won't take the place of the motor—or brakes).

I is for INTELLIGENCE—(if you have such
And use it, you don't need this Alphabet much).

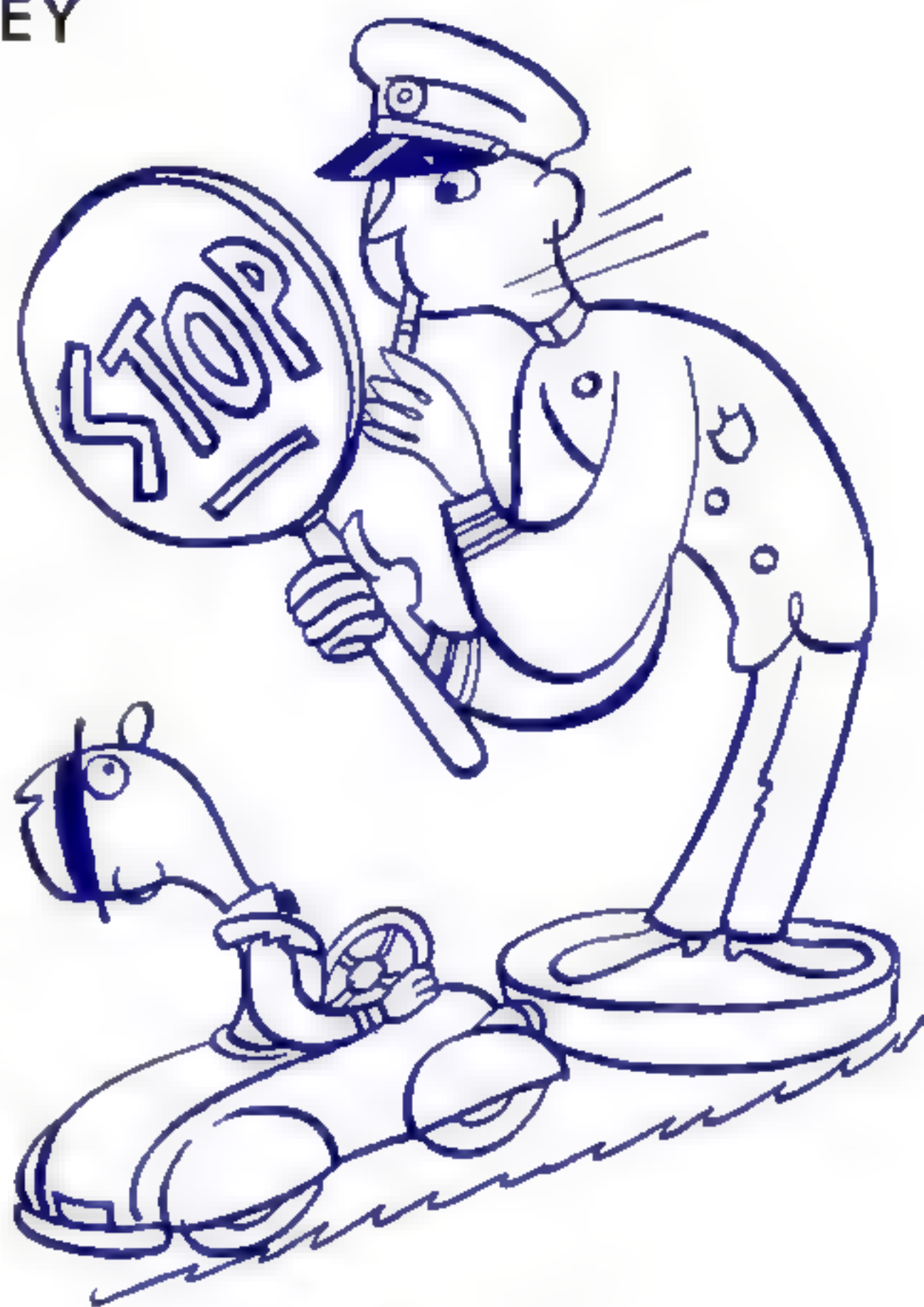
J is for JUGGERNAUT, i.e. your car
Unless you use JUDGMENT, wherever you are.

K is for KNOWLEDGE that two tons of steel
Is, roughly, the weight of your automobile.

L is the LOGIC which leads you, in turn,
Straight to the LESSON that drivers must learn;

M (for MOMENTUM) is rather a glum thing
When two tons of metal career into something!

N is for NINCOMPOOP, NUMBSKULL, and NUT,
Which "weavers" in traffic are nothing else but.



O's for OPINING—the wisest of rules—
That OTHERS who operate motors are fools!

P is for PATIENCE with that kind of people
(Maybe *they* think there are bats in *your* steeple!)

Q's for the QUESTION about right of way
—Let the guy have it. Why perish today?

R's for REACTIONS—both safer and quicker
If you don't make a copilot of liquor.

S is for SIGNALS, the fellow behind
Must read your hands—for he can't read your mind!

T is for TRUCKS as they rumble along,
Remember, they always are right, though they're wrong.

U is for UNCTUOUS, UNVEXED, URBANE;
A good attitude—but it's tough to maintain!

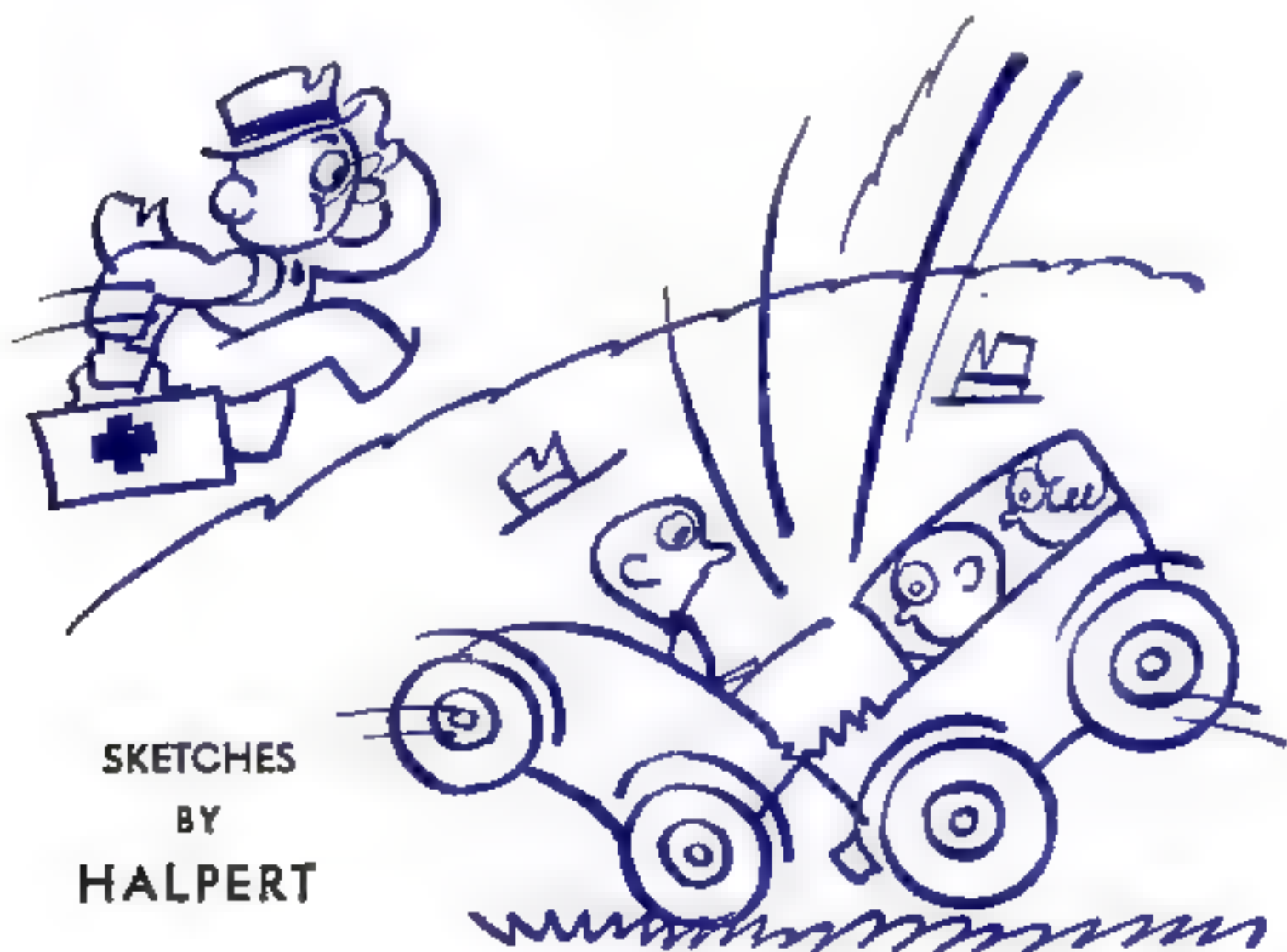
V is for VITUPERATION—be sure
The guy that you use it on's smaller than you're!

W's WATCHFULNESS, absence of which
Makes doctors and wrecking-car companies rich.

X marks the spot where, on some future day,
The "getter-away-with-it" won't get away!

Y—this means YOU, for whom all of this verse on
The driving of cars is intended in person;

Z is for ZERO—or how much attention
We may expect for these matters we mention!



SKETCHES
BY
HALPERT

Radio Repair Man Uses Patrol-Car System



Two-way radio set in repair man's home and, at upper right, the midget transceiver he takes with him in his car to pick up service calls relayed by his wife



WITH combination sending and receiving sets installed in both his home and his car, a radio-repair expert of San Francisco, Calif., is always available when customers call for service. When he is not at home to receive a phone call, his wife snaps a switch and relays the message to him as he is traveling from one job to another in his automobile. The transceiver in his automobile, he claims, is one of the most compact ever constructed. The arrangement enables the repair man to "cruise" from job to job without loss of time.

Odd Underslung Pillow Checks Seasickness

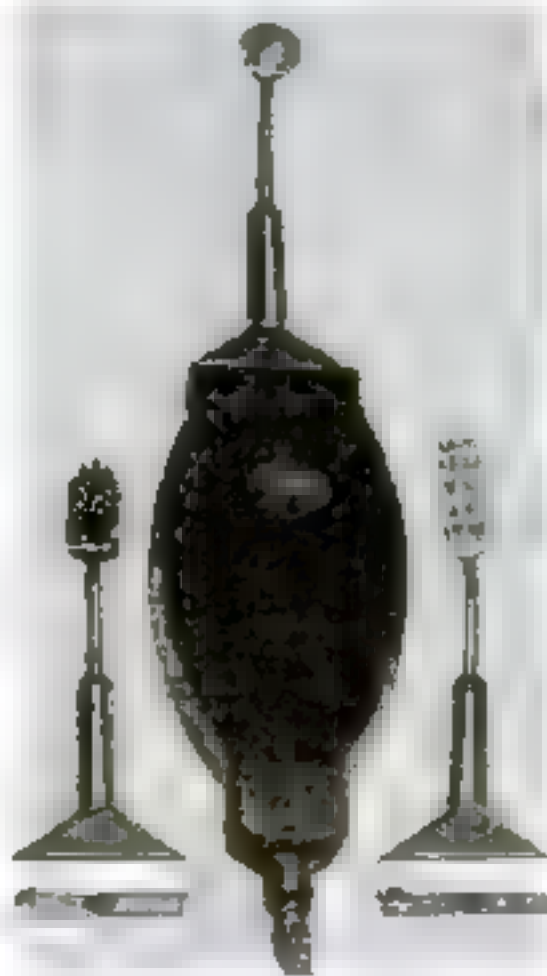
SUSPENDED on springs from a metal frame, a novel pillow of porous rubber is said to aid in preventing seasickness. Absorbing the roll and pitch of the ship, the cushion keeps the head almost stationary and so reduces the disturbance in the inner ear which is commonly believed to cause the ailment. The pillows are now in regular use on Dutch passenger liners. They are also said to be effective in preventing airsickness.



This swinging headrest is said to ward off seasickness

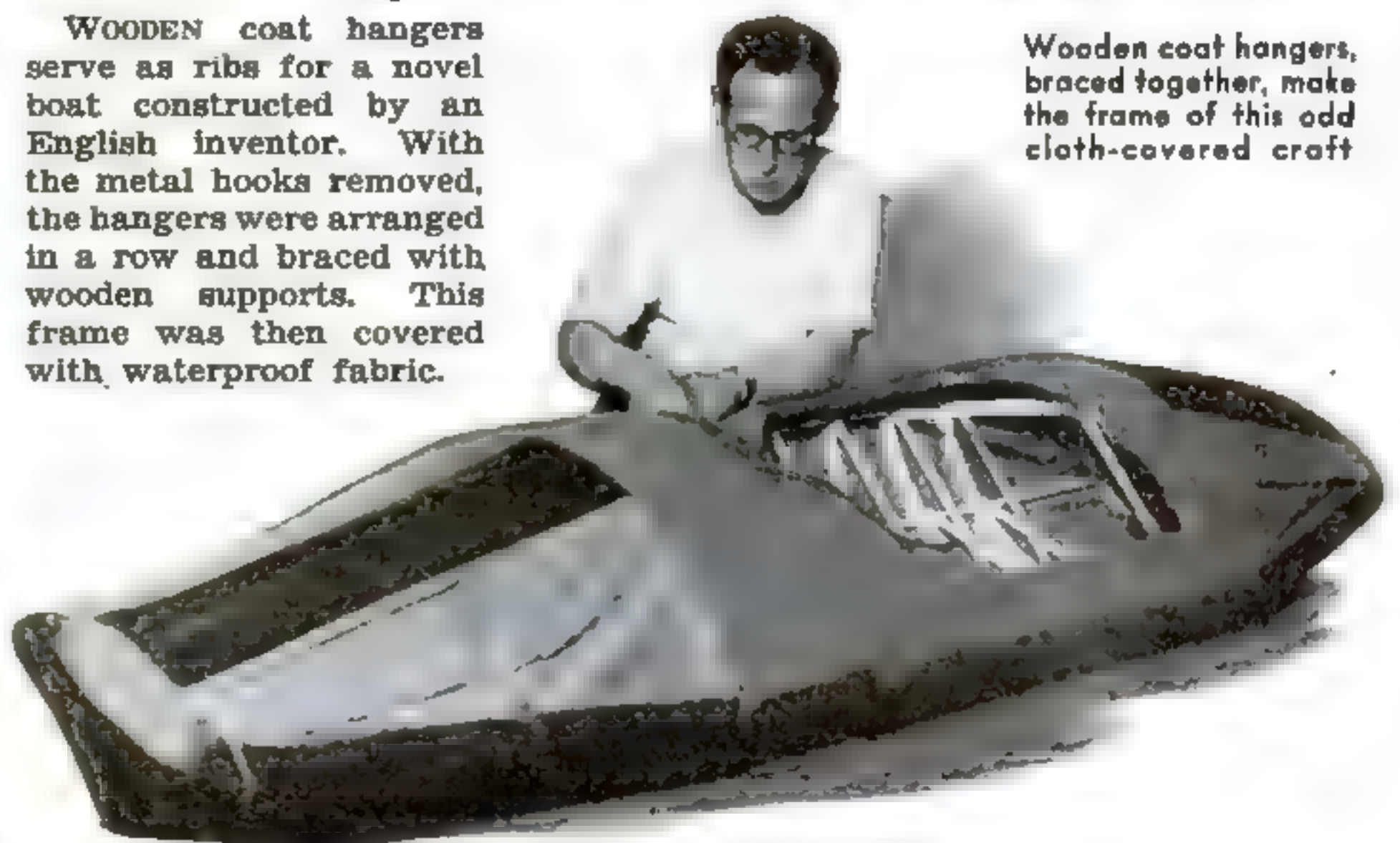
Electric-Razor Attachments Give Manicure And Massage

ATTACHMENTS just introduced for razors of the electric type allow the owner to use the device to massage his face or scalp, manicure his nails, or brush his teeth. The appliances, which are easily attached to the rotary shaft of the razor in place of the cutting mechanism, include a rubber cup for massaging the gums, a bristle brush for the teeth, and an emery file and felt buffer for grooming the nails.



Coat Hangers Form Ribs of Novel Boat

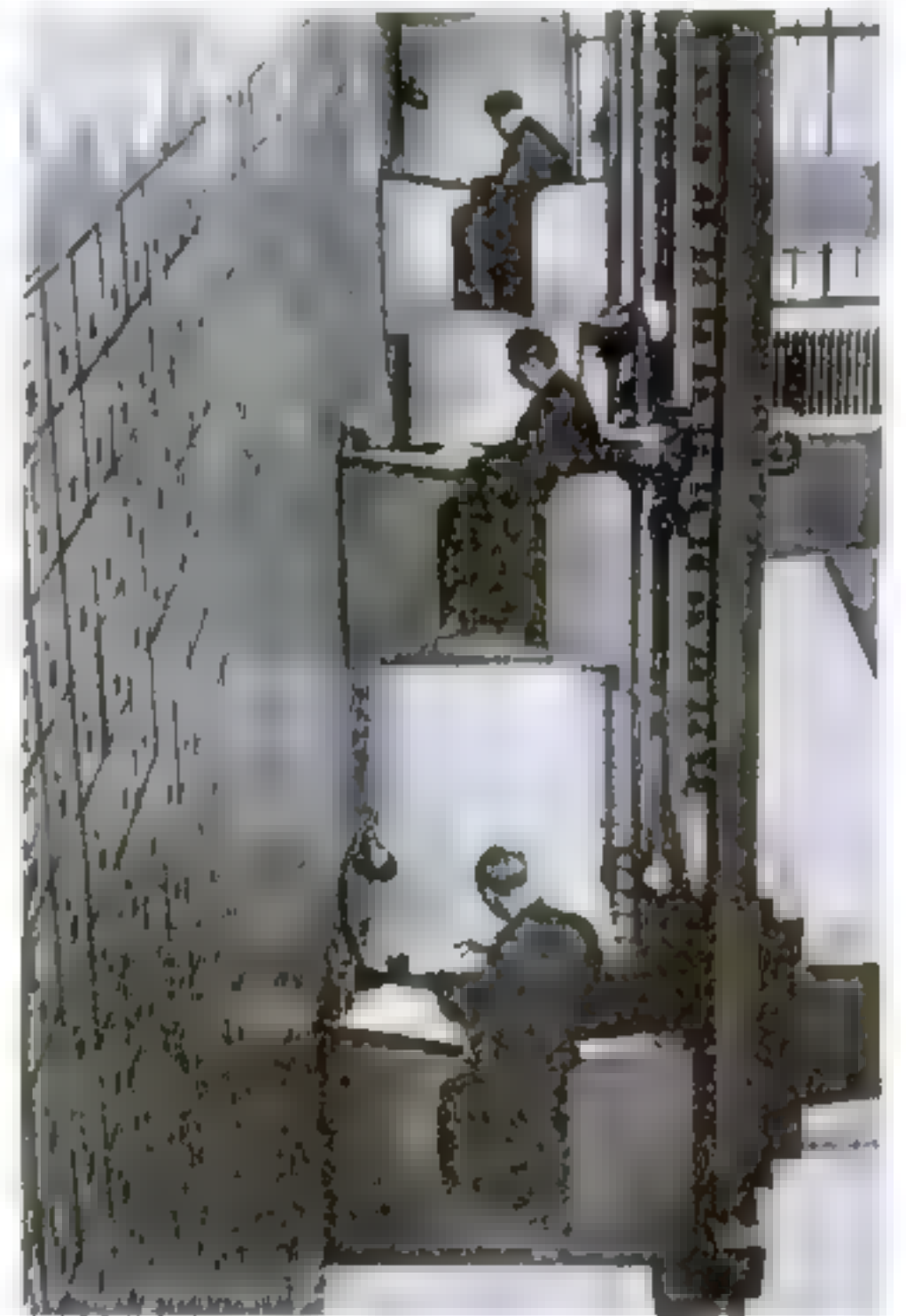
WOODEN coat hangers serve as ribs for a novel boat constructed by an English inventor. With the metal hooks removed, the hangers were arranged in a row and braced with wooden supports. This frame was then covered with waterproof fabric.



Wooden coat hangers, braced together, make the frame of this odd cloth-covered craft

World's Largest File Has Traveling Desks

CLERKS ride up and down on "elevator desks" to consult the gigantic correspondence file of a Czechoslovakian insurance organization. Said to be the largest in the world, the huge letter file consists of 3,000 drawers, each ten feet long, covering 4,000 square feet of wall space and extending sixteen feet up from the floor. Clerks press control levers to move their desks up, down, or sideways until they reach the desired file drawer, which opens automatically.

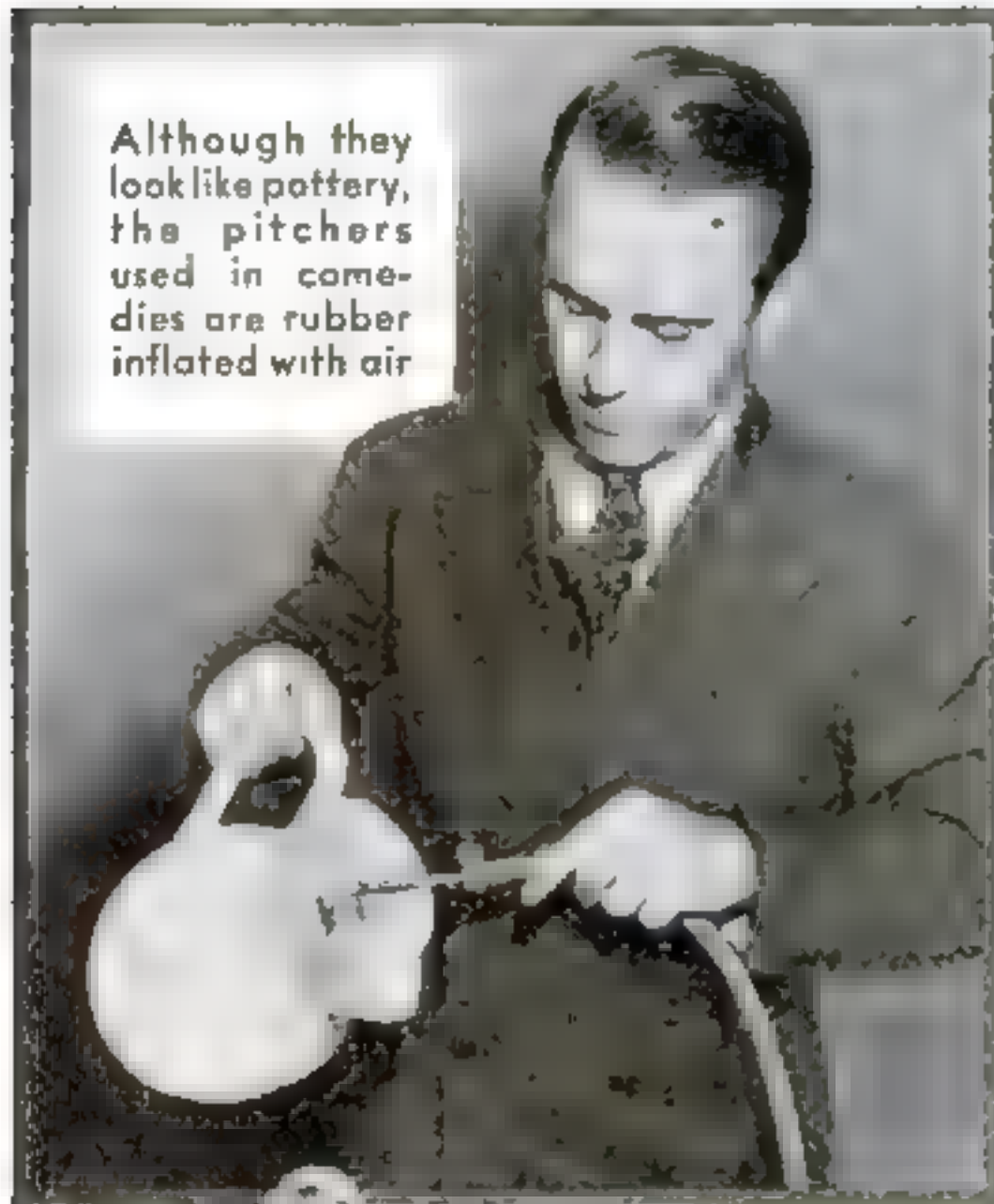


Clerks examining correspondence in the mammoth file of an insurance company

Chemical Aids Dishwashing

Soapy film left on dishes washed by ordinary methods is peeled off completely if a chemical called sodium metaphosphate is added to the wash water, recent experiments indicate. Removal of the film not only improves the appearance, but rids dishes of germs.

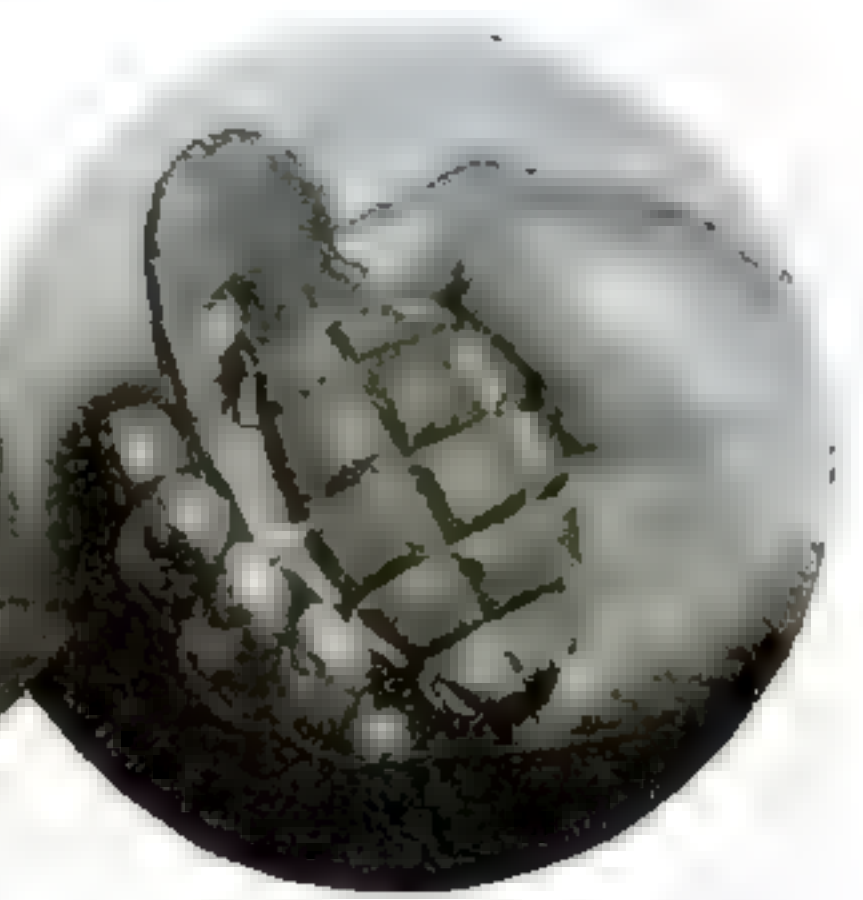
Rubber Guns and Spears Safeguard Movie Actors



Although they look like pottery, the pitchers used in comedies are rubber inflated with air



Few movie guns, handcuffs, and manacles are real. Soft models safeguard actors



In war scenes, soft-rubber grenades protect the "soldiers" from injury

in the scenes without endangering themselves.

In Merralls' stock can be found almost any rubber item needed in pictures, from six-shooters to hand grenades. He has twenty-one types of revolvers and automatics, as well as blackened rubber chains for use in chain gang scenes. Even the pitchers on his shelves are made of rubber painted to resemble china. Inflated bladders cause them to

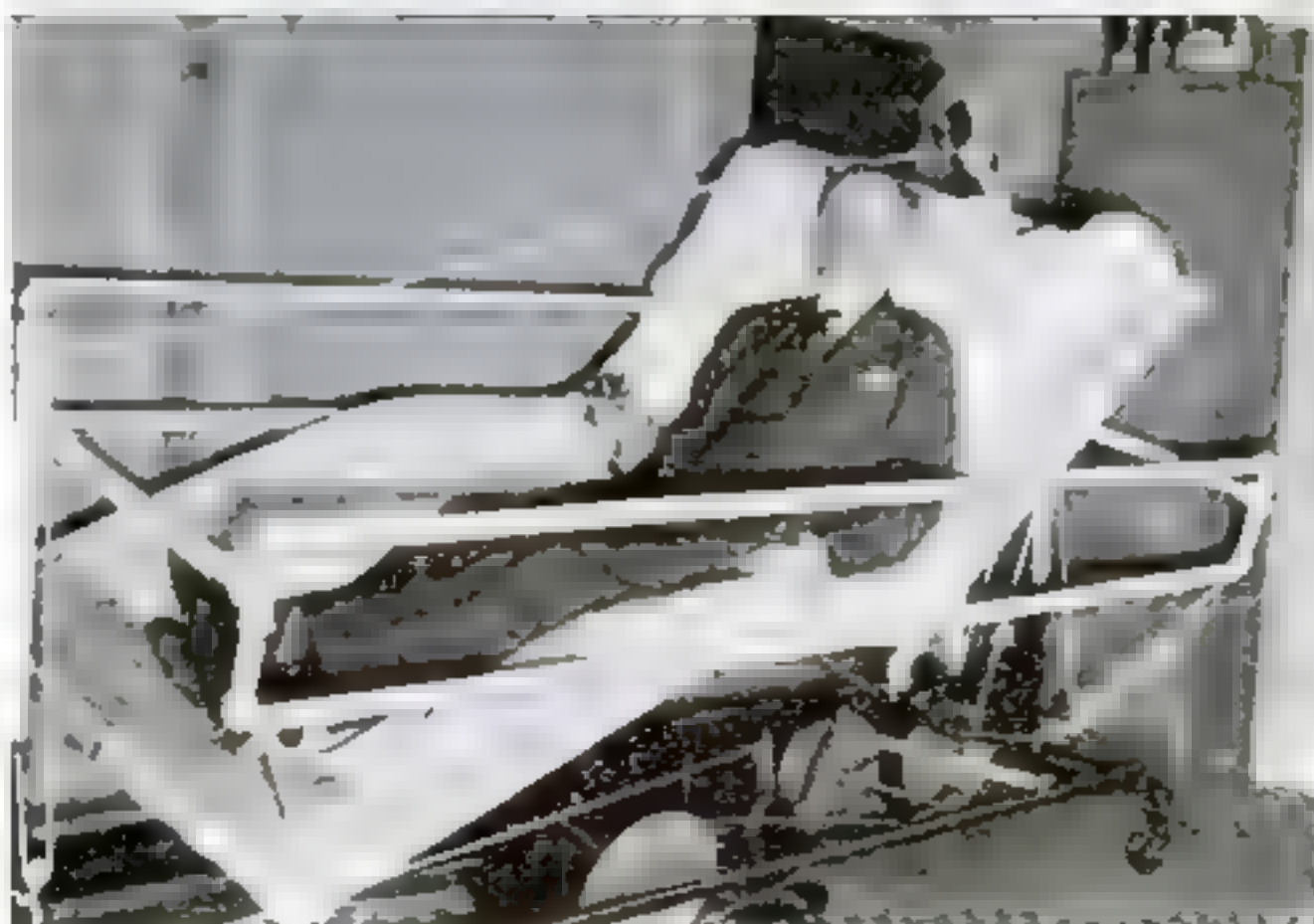
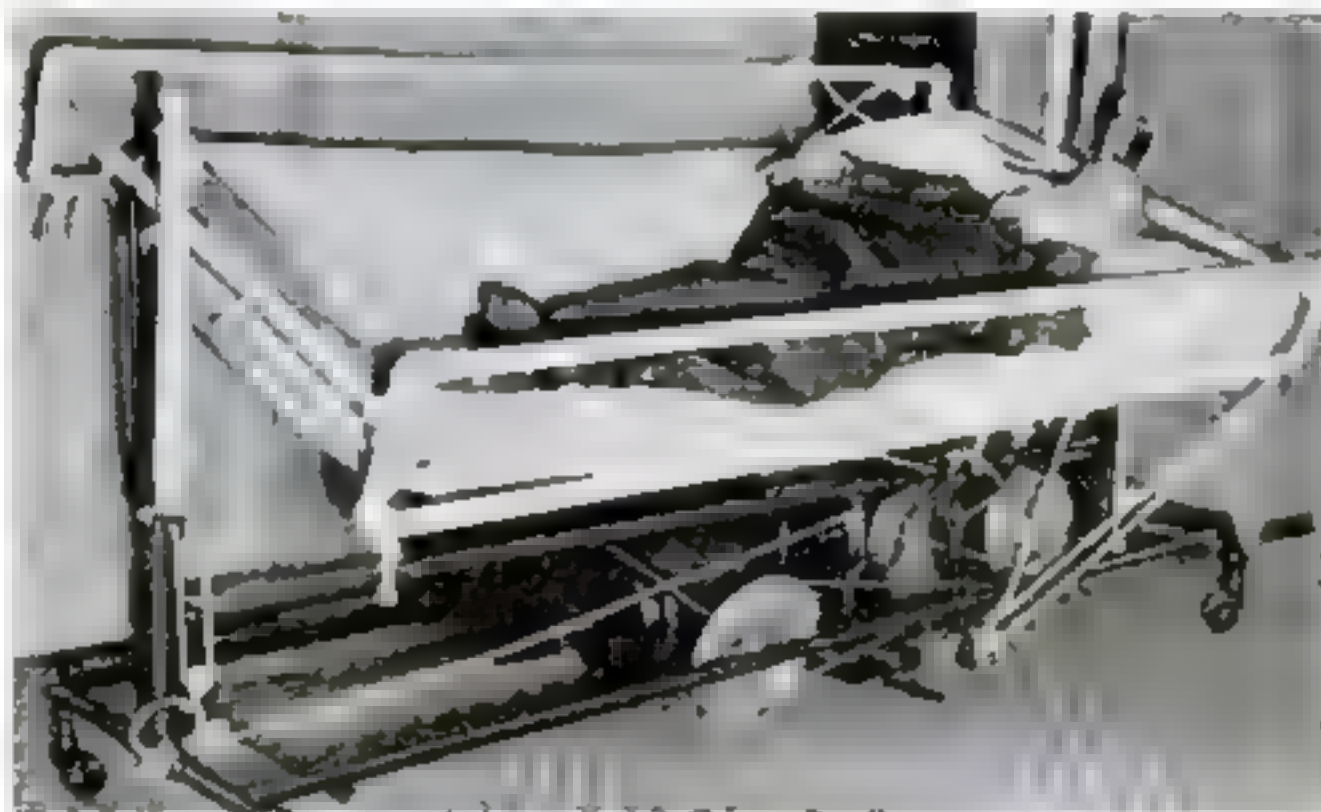
WHEN a movie comedian strikes the villain with a pistol butt or an alligator grabs an actor by the leg, you are probably seeing rubber props shaped and painted to look like the real thing. Rubber weapons, cooking utensils, animals, handcuffs, and chains are among the "soft" props created by Charles N. Merralls, Los Angeles man-

ufacturer, for movie use. These devices are not used to deceive audiences, but to safeguard actors, in mob scenes and other dangerous sequences. On one occasion, Merralls produced the forward halves of eight alligators for a swamp scene; on another, he shipped 500 rubber-tipped spears to Africa so natives might "battle" each other realistically,

bounce when dropped or struck against a man's head. To produce the rubber alligators, workmen first carried a real 'gator in its dormant state to the studio, where a plaster cast was made. The cast was then separated into ten sections. Aluminum molds were formed from which rubber-compound "alligators" were fashioned.

Motorized Bed for Invalids Adjusts Itself

HOSPITAL patients who are partially paralyzed or too ill to move themselves can shift their position at will in a motorized bed invented by Dr. C. E. Sharp at Ohio State University. Mounted under the bed, an electric motor, controlled by a push button in the patient's hand, drives an arrangement of gears and pulleys to raise, lower, or tilt the spring and mattress into various positions. Thus the patient can bring himself to a sitting posture or turn his body from side to side with no effort but that of pressing a button. The bed is said to make its various movements smoothly and gently, without jerking or otherwise paining a delicate invalid. Dr. Sharp spent two years in developing this motorized bed.



By pressing push buttons, helpless patients can control this motorized bed to shift themselves into any position desired

Portable Score Boards Used in Golf Tourney

TRAVELING score boards, carried beside the players, kept spectators informed of the standing of contestants at a golf tournament held recently at Aspinwall, Pa. The photograph below shows Denny Shute, winner of the contest, at the right, and an attendant carrying the sign that bears the champion's name and his standing.



Denny Shute, right, and the score board that bears his name and his golf score



Pipeline Meter Gauges Enlargement Exposure

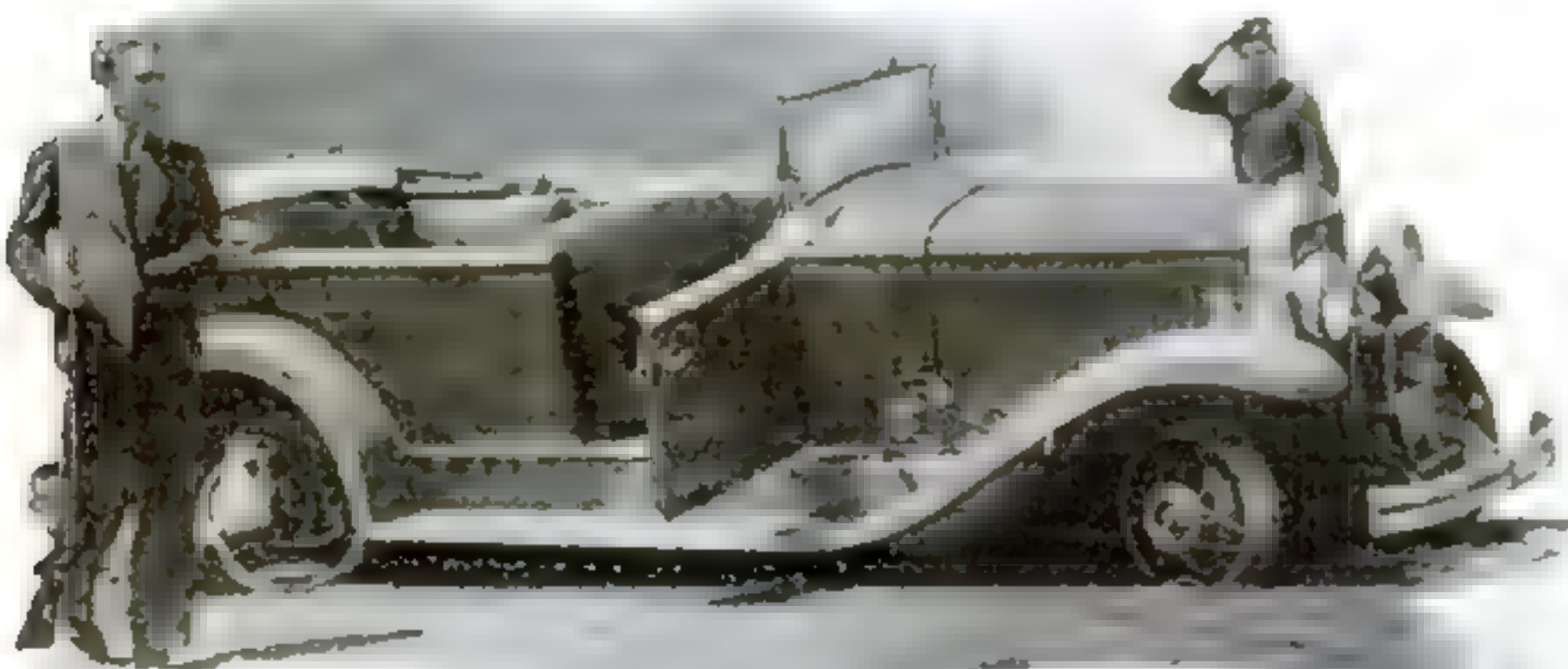
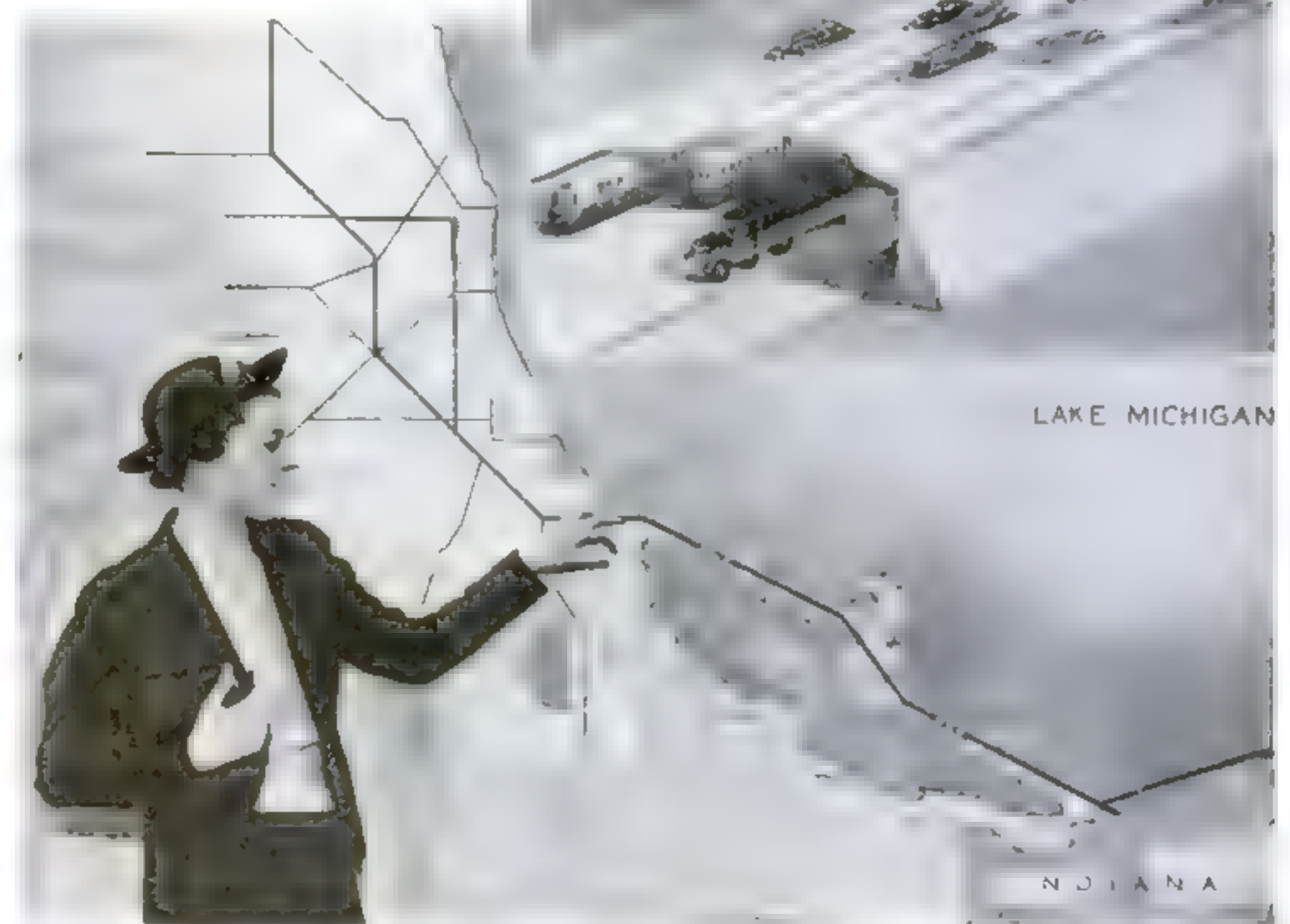
A NEW instrument shaped like a tobacco pipe determines the correct exposure for any negative in photographic enlarging. The "bowl" is placed on the bottom of the lens of the enlarger after the negative has been put in place and the light within the enlarger switched on. Looking into the "stem," the user sees a series of semi-transparent numbers of varying opacity. The lowest number that can be read easily determines the required exposure.

Highway To Snip Off End of Lake Michigan

TO RELIEVE traffic congestion around Chicago and make it easier for motorists to drive from Illinois to Indiana, a proposed double-decked superhighway would span the southern tip of Lake Michigan. Present plans call for a six-

lane upper deck for pleasure cars and a four-lane lower deck for busses, trucks, and trains. Piers edging the landward side of the highway will provide additional accommodations for ships and create a giant harbor.

Map of proposed overwater highway out of Chicago. Inset shows lower deck for trucks, busses, and trains



Stabilizer Holds Car Straight After Blow-out

DELIBERATELY shattering a tire by firing a shotgun at a front wheel of a speeding automobile, demonstrators of a new steering stabilizing device recently displayed its ability to keep a car from suddenly swerving after a blow-out. Connected to a car's steering mechanism, the unit consists of a hydraulic cylinder and piston that locks itself momentarily when a sudden shock is transmitted to it through the car wheels. The safety device is said



Driver raising hands from wheel as gun is fired to blow tire. At top, all tires flat after test

not to interfere with normal steering, and the makers claim that it provides positive protection against accidents and smash-ups due to tire blow-outs. The device also is said to eliminate "shimmy," and to aid steering on rough roads.

Portable Fan Sucks Smoke from Burning Building

POWERED by a small gasoline engine, a new portable smoke ejector recently tried out by New York City firemen is designed to clear a smoke-filled building or room so that fire fighters may safely enter. The unit, sucking the fumes out through a long, flexible pipe, draws out 4,000 cubic feet of smoke a minute.



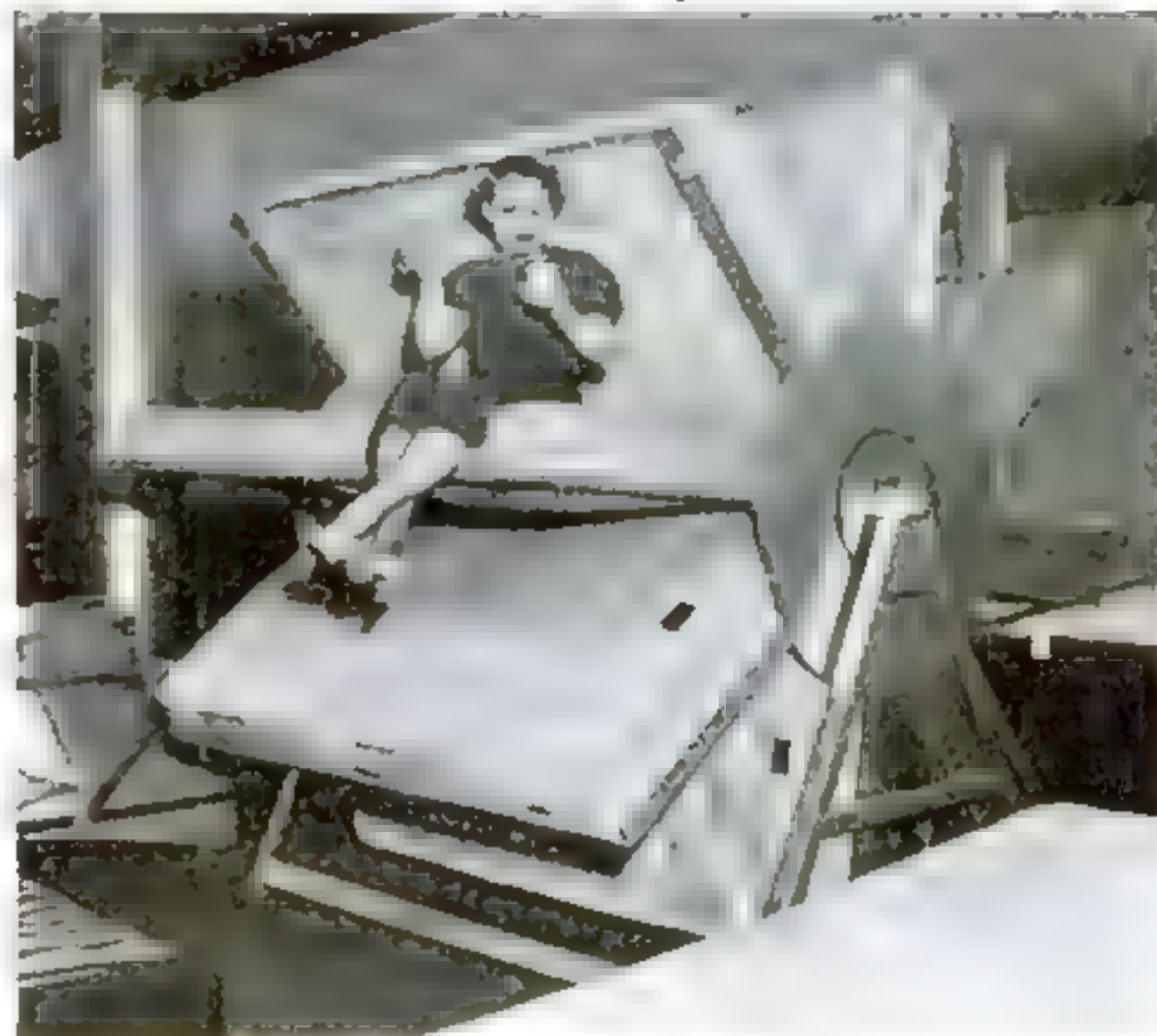
Fan and flexible pipe used to clear buildings of smoke

Will Is Recorded Orally on Sound Film



SOUND-RECORDING apparatus took the place of paper and pen when Glen Gray, well-known orchestra leader, recently made his will. Seated before a microphone as seen in the photograph at the left, Gray read the document drawn up by his lawyer, and his words, together with the oral signatures spoken into the apparatus by three witnesses, were preserved on sound film. This is believed to be the first time that a will has been made in vocal form with film-recording apparatus.

Odd Rack Displays Mattresses



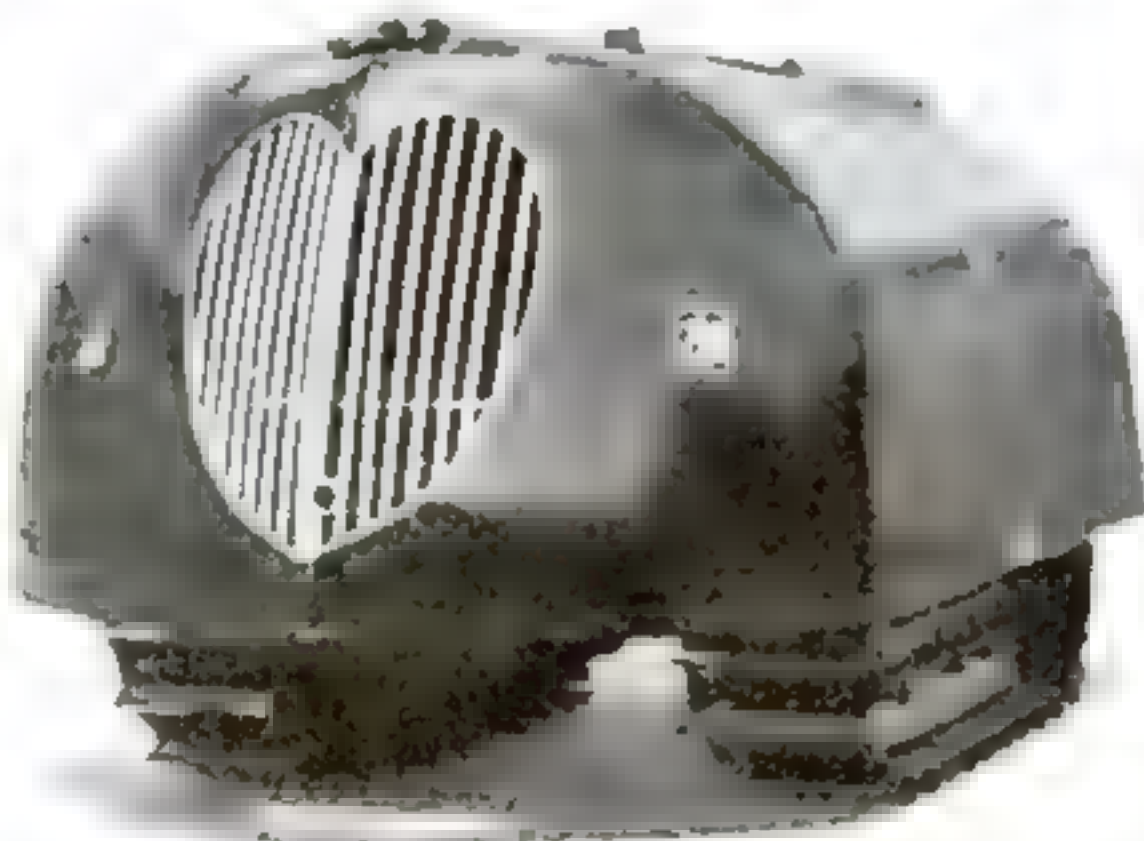
Revolving rack for showing mattresses in a wholesale exhibit

LOOKING like the paddle-wheel blades on an old-time river steamboat, mattresses are displayed effectively in a novel device used in a Chicago, Ill., exhibition of household wares. To conserve space and make it easy to show both top and bottom, the mattresses are fastened to metal frames that revolve around a central axis held off the floor by metal supports. The rack holds eight mattresses.

Glen Gray, orchestra leader, reading his will into sound-recording apparatus

Orchard Tractor Is Streamlined To Spare Trees

TRACTORS designed for use in California citrus orchards have been fitted with smooth outer shells of steel to cover exposed parts that otherwise might catch in low-hanging branches, and cause damage to trees or ripening fruit.



This tractor's smooth shell lets it pass among trees

Tower Sprays Blanket of Fog To Save Crop

TO PROTECT delicate crops from summer heat and winter cold, Arthur S. Martin, of Tujunga, Calif., devised the novel fog tower illustrated. The 100-foot steel column has atomizer jets at the top which spray a mist of tiny water particles into the air to shield the fruit from a scorching sun, or to blanket the orchard in winter to help it retain its stored-up heat.

Hearing Aid for the Deaf Is Worn Under Clothing



New bone-conduction apparatus strapped in place

TO PROVIDE an inconspicuous hearing aid for the deaf, a new device is harnessed to the back of the user underneath his clothes. Of the bone-conduction type, the apparatus transmits amplified sound vibrations to the spinal column, and the bone structure conducts them to the nerves of the inner ear. A battery and microphone complete the unit.



Pump in base of tower forces water through tiny jets to form a mist



Metal Plating Applied With Electric Brush

METAL plating is applied with an electrified brush in a novel process just invented. Plugged into an electric outlet, the brush is dipped in a special plating solution and wiped over a surface as shown in the photograph above. Speedy in operation, the apparatus is handy for touching up worn spots, or for completely plating small articles.

Prof. Charles C. Weideman and four boys playing what is said to be the world's largest xylophone, made of wooden bars with cardboard mailing tubes as resonators



MUSICAL MAGICIAN

By
GEORGE
DACY

COAXES TUNES FROM STRANGE MATERIALS

MUSIC from turkey bones! Gay tunes from glass, pieces of garden hose, and canceled bank checks! These are some of the miracles wrought by Prof. Charles C. Weideman, of Ohio State University at Columbus, with the hundred-odd home-built devices that make up one of the world's strangest collections of musical instruments.

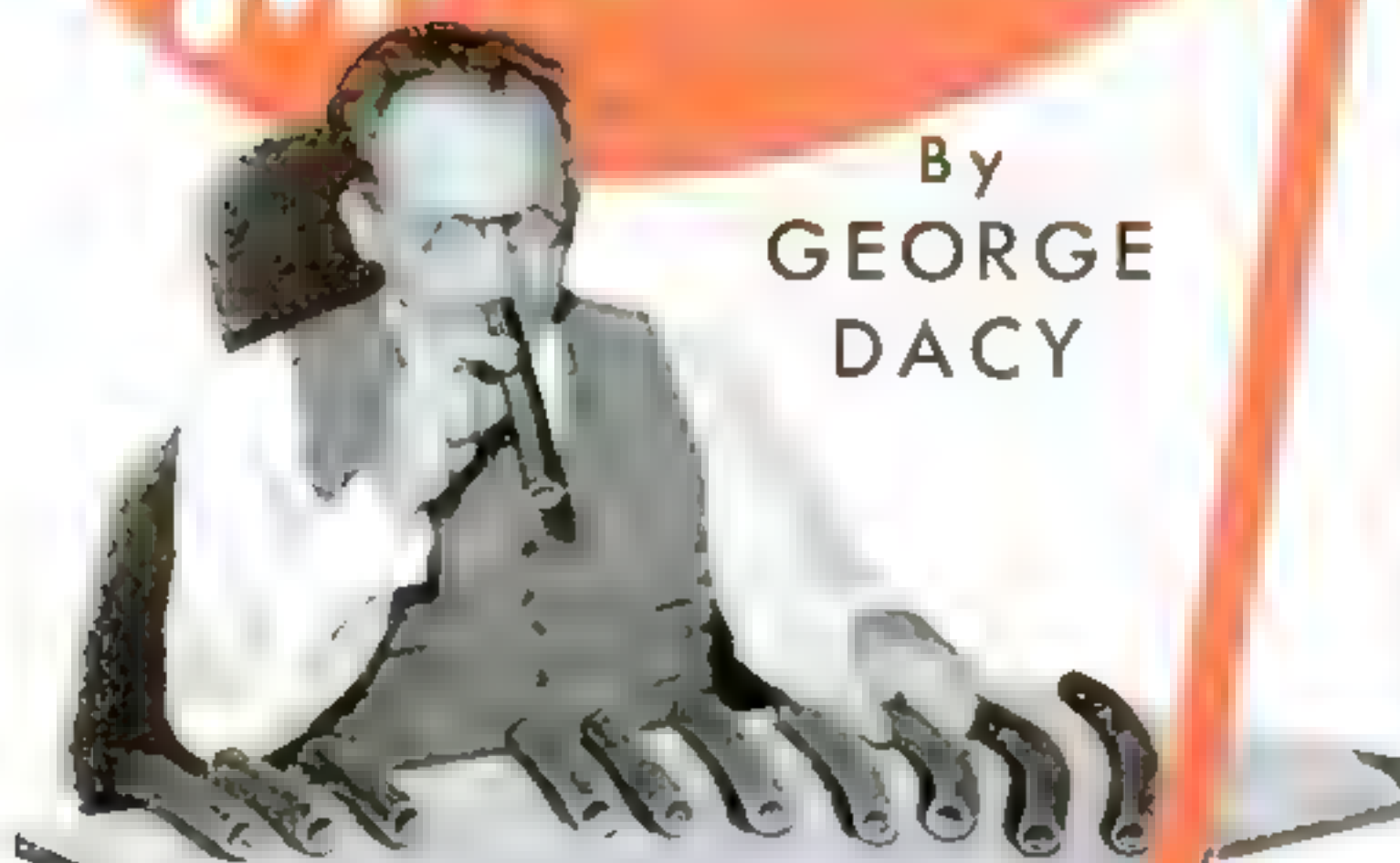
Ever since the time when, as a boy of ten, he tuned the pickets of a fence in front of his home by cutting them to various lengths, and played melodies on them with mallets, Weideman has spent most of his spare time coaxing music out of unlikely materials. One of his

first inventions, which he still plays on occasion, was a "mopaphone," a curious contraption that utilized a mop handle, a cigar box, a piece of wire, and a hair plucked from a horse's tail. With the wire stretched taut over a bridge made of wood screws, a crude bow drew forth notes that radiated from a cigar-box sounding board.

Later on, young Weideman progressed to the "kindletone," so called because its main elements were scraps of kindling wood. Noticing that sticks of varying length produced different musical tones when struck together, the young musical inventor tuned a batch of them by sawing them up into different lengths until he had a range of three octaves. Then he laid them across tubes made from rolled newspapers, and played the instrument with homemade wooden mallets whose heads were swathed in twine.

Weideman constructed a xylophone with resonators when he was a sophomore in high school. It worked like a charm, but it was forgotten almost as soon as it was completed, for its maker conceived the "glassaphone," another bizarre contrivance whose musical tones come from rows of jelly jars filled to varying levels with water.

So it went. As soon as one musical device had been designed, built, and mastered, it was abandoned for something new. Weideman still spends much of his time trying out new instruments and teaching a group of youngsters how to build and play them. In a workshop provided by the College of Education at Ohio State University, the boys build "mopaphones," and xylophones of various types. One of the latter, called a "bugletone," has four sound bars shaped from blocks of ma-



Coaxing music from short lengths of garden hose



A piece of ordinary mailing tube, fitted with sliding pistons to vary its pitch, being played like a common slide whistle



"Bugletones," odd four-note percussion instruments, give the effect of a bugle corps

man happened to pluck a stalk of wild celery while on a picnic in California. Noticing that the stalk was hollow, he took out a pocket knife and converted the celery shoot into a one-octave flute by jabbing a line of finger holes along its length and whittling one end into a simple mouthpiece. And last summer, while examining the construction work on the San Francisco-Oakland Bay Bridge, he found a way to hammer a tune out of a row of drift pins, the eight-inch bolts that are used to line up rivet holes in sections of steel plate.

Many of these odd instruments that Weideman builds would rate as little more than freaks were it not for the long training, rare musical talent, and amazing manual dexterity of their maker. Such is the case, for instance, when he blows a tune on sections cut from an old garden hose. Laying them on a table in the order of their respective pitch, he picks them up, blows them like whistles, and returns them to their correct places with lightning speed. The same combination of speed, dexterity, and perfect timing is necessary to play a trumpet-like wind instrument made out of canceled bank checks, glued together to form paper (*Continued on page 117*)



Strips of plate glass, struck with padded mallets, produce music in this "celestaphone"

hogany and mounted in a wood frame over cardboard resonating tubes. Requiring only one mallet to play them, and limited to the four notes of the conventional bugle, these curious instruments are easy to master, but when played in concert, they produce an orchestral effect like that of a complete bugle corps.

Another popular instrument constructed by the boys is the "rodario," which produces music through the vibration of a row of eleven vertical birch rods anchored in holes drilled into a wooden base. Each of the eleven rods is three-eighths of an inch in diameter, but they vary in length from one to four feet. This odd tune maker is played by coating the fingers with rosin and stroking the rods.

In following up his hobby, Weideman acts on the principle that any material that will vibrate can be made to produce music. No matter how remote from the realm of melody a substance may be, he invariably discovers a way to tune it and produce a harmonious instrument.

Not long ago, for instance, he went on a hiking trip into the wilds of the Sierra Nevada mountains in California. There, far from any workshop, he lured melody from ordinary rocks. Col-



Weideman extracting music from a mop handle, a wire, and a cigar box

lecting a batch of loose stones, he chipped and cut them against each other to assemble a crude "rockaphone" which he played with two small hammers for mallets. Later on, he played a set of tuned rocks before an audience of 12,000 who had assembled for an annual pilgrimage to a mountain top in Utah.

On another occasion, Weide-



Another xylophone-type instrument that employs glass instead of wood



A youngster learning to play the "rodario," in which wooden rods are stroked with rosin-coated fingers

JACK-OF-ALL-TRADES...

The Telegraph Boy

ONCE telegraph messengers spent all their time delivering telegrams—but that was in the days when drug stores specialized in drugs, and cigar stores in tobacco. Today, you can call upon a messenger boy to perform any legitimate service, at a flat hourly fee.

A telegraph messenger will take your children to the movies, walk your dog, rescue your pet cat from a high limb, mow your lawn, and hang your curtains. He will make a fourth at bridge, read to elderly or lonely people, or chat entertainingly about current events. If you have locked yourself out of your house, a messenger boy will climb through a window and let you in. He will shower a bridal couple with rice for you, when you are unable to attend a wedding.

In one Pennsylvania city, a messenger responded to an urgent summons, to find the secretary to the mayor standing on top of her desk, frightened by a mouse. She would not descend until he had killed the animal and exhibited the remains.



A good Samaritan in uniform. Telegraph boys are adept at rescuing cats from high limbs of trees



Genteel housebreaking is in order when keys are forgotten



Elderly persons often call in messengers to talk or read to them. Mowing lawns is another very common assignment



Taking children to and from school, or to the movies, is a service that is greatly appreciated by mothers



Absent friends may have rice thrown for them at a wedding



Nicola Tesla, noted inventor, hires a boy to feed the pigeons in front of the New York Public Library daily



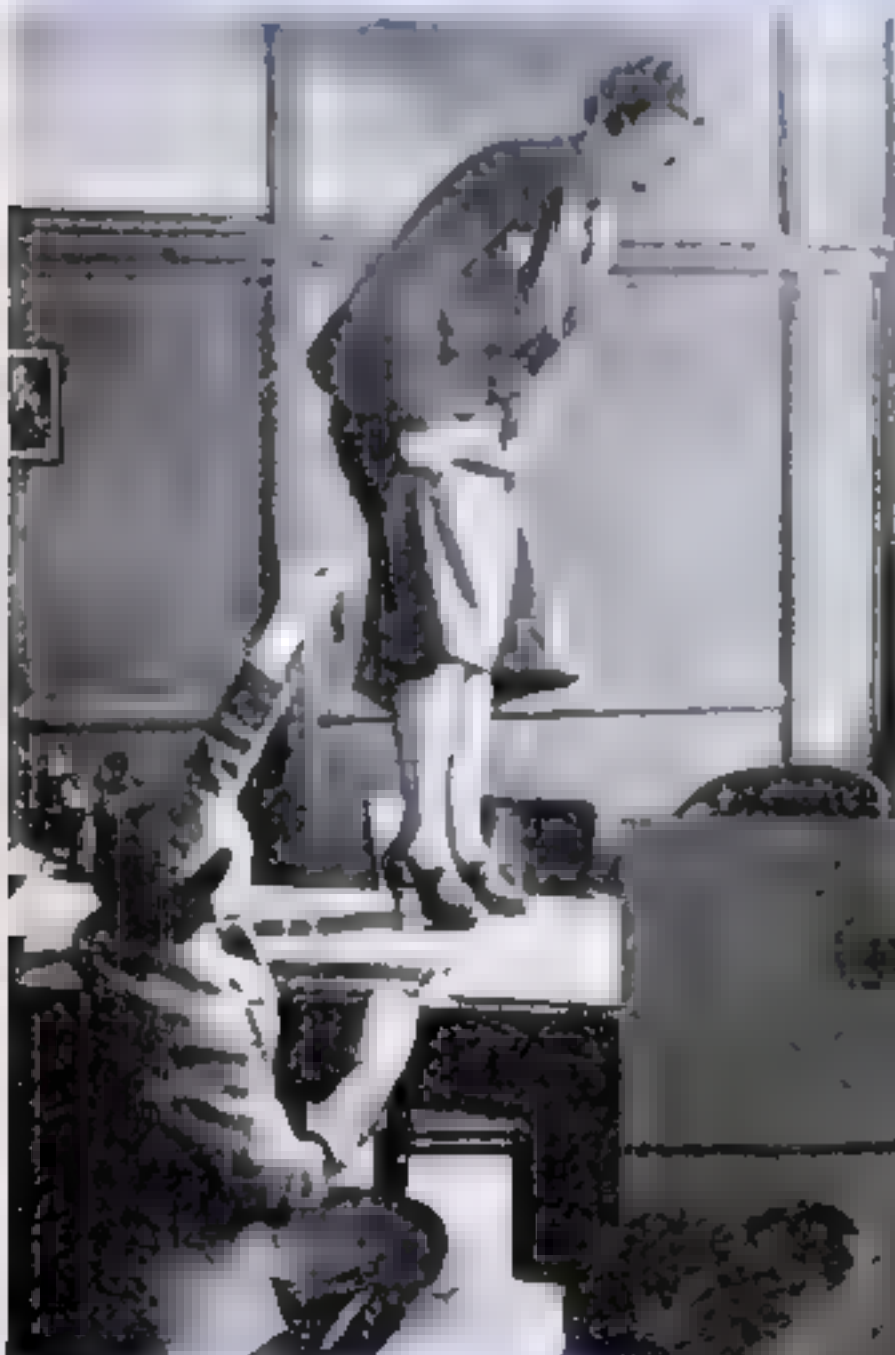
Shopping for busy housewives, messengers match colors, check sizes, and judge quality with skill



Walking the dog is a welcome change from delivering telegrams, this boy's smile indicates



Timid housewives need not venture on to ladders to hang their draperies



Doubling for the milkman, Mothers' milk is delivered to New York City hospitals from a central station in iced containers daily by telegraph boys



Below, a sudden shortage of caddies at the golf course is easily remedied



In at least one case, a messenger was called by a terrified secretary "treed" by a mouse. The lad pursued the animal and killed it



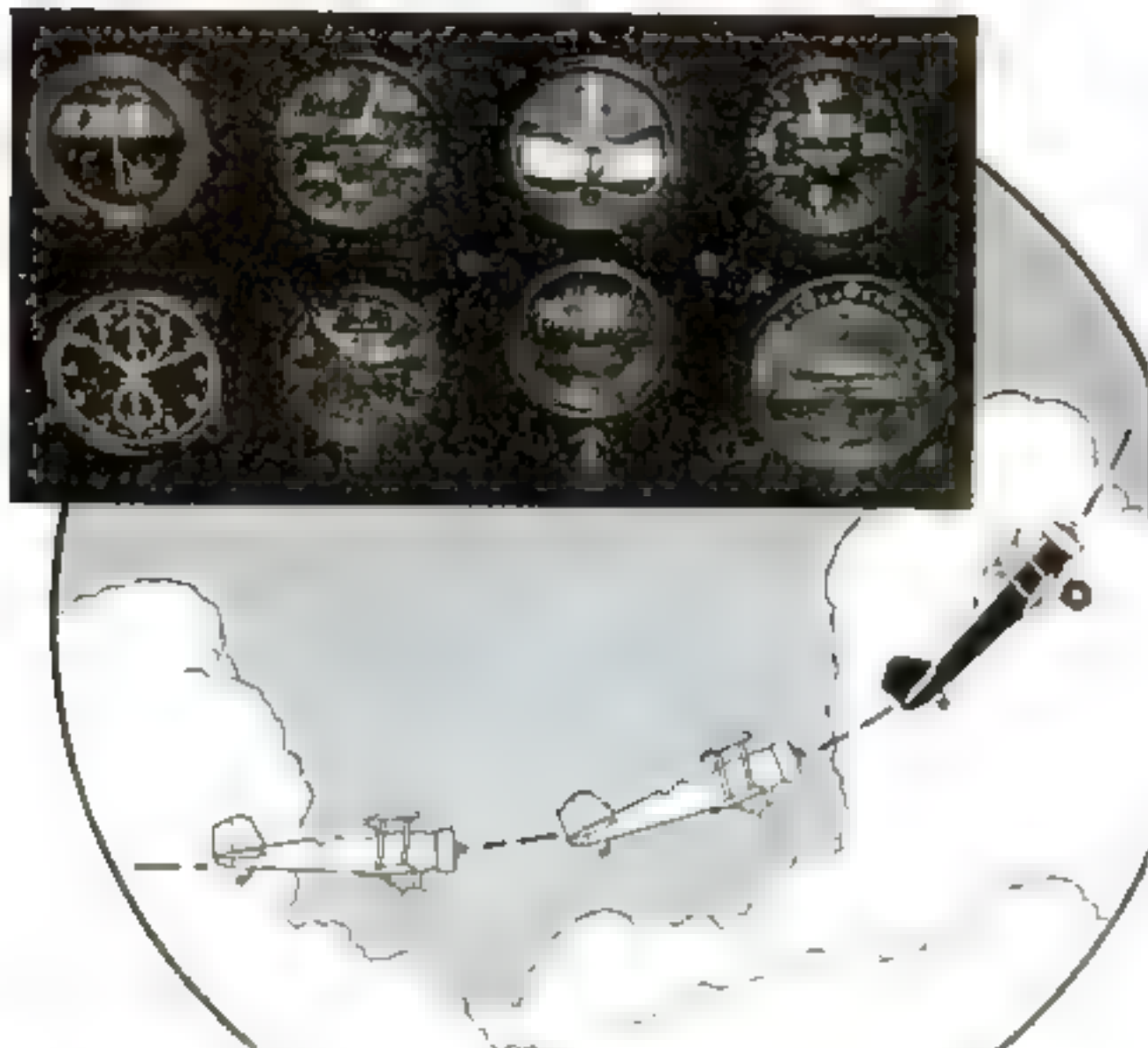
"Canned" lectures, illustrated with a projector, are available on a wide range of subjects for school and business groups. A messenger boy sets up and operates the portable phonograph-projector apparatus

EYES

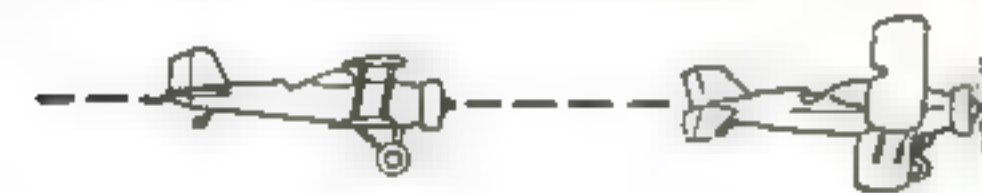


THIS IS WHAT THE PILOT SEES

Typical instrument panel in a small plane, showing the dials that tell a pilot what his plane is doing at any given moment. They are (1) magnetic compass; (2) air-speed indicator; (3) bank-and-turn indicators; (4) vertical-speed indicator; (5) clock registering regular and elapsed time; (6) altimeter; (7) directional gyro for turns and landing; (8) gyro-horizon, with artificial horizon that shows when the plane is tipped fore-and-aft or sidewise. The pictures below show the dials registering flight conditions



FAST CLIMB. As the pilot pulls back the stick, the vertical-speed indicator reports that the plane is rising 800 feet a minute. The air-speed indicator tells that the craft is going fast enough to avoid a stall. Note how the gyro-horizon shows the nose tipped up



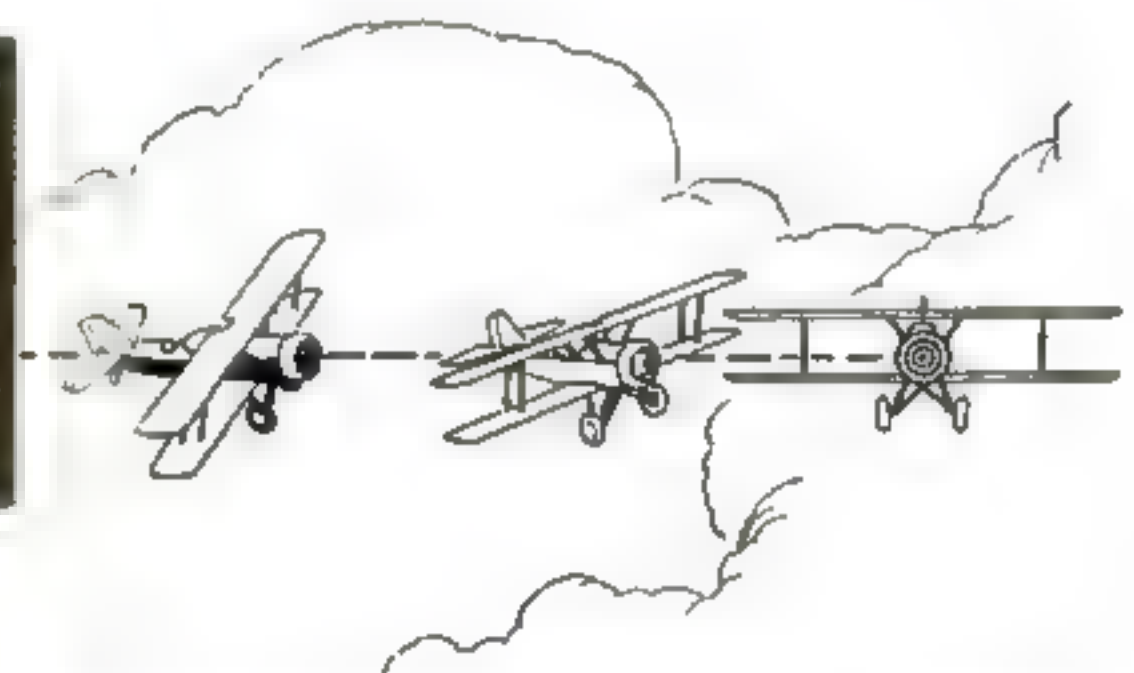
TURN. Here the gyro-horizon, turn indicator, and air-speed indicator unite to paint a picture of a wide, graceful turn to the right at a 115-mile-an-hour clip. The steel ball in the bank indicator assures the flyer that he is banking his ship at just the right angle required for the turn at this speed



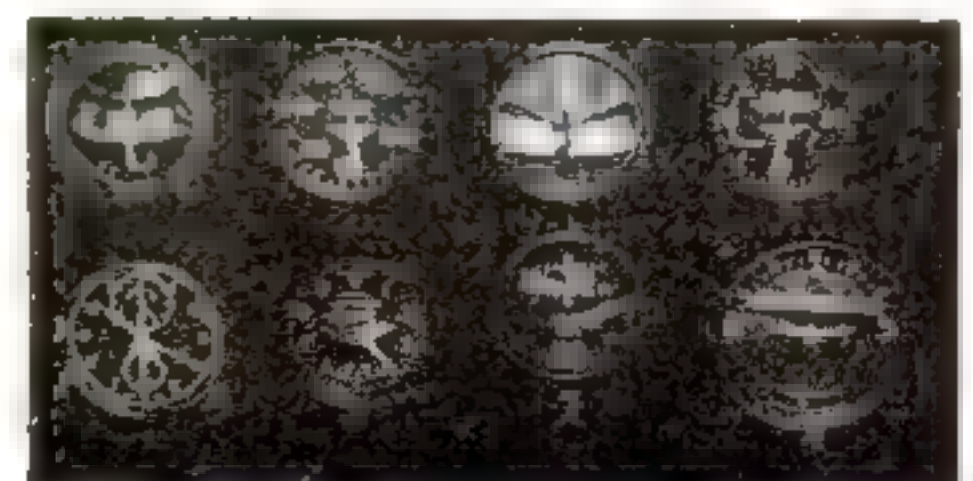
CLIMBING TURN. Spiraling upward to the right at good air speed, is the story told by the turn indicator, vertical-speed indicator, and air-speed indicator. The gyro-horizon shows the plane banking gently and the steel ball of the bank indicator, at center, proves again that the banking angle is correct

FLYING "blind" through fog and darkness, modern airmen depend upon their instruments for safe guidance to their destination. Would you know how to read the dials? Study the pictures on these pages, and you will understand how a pilot flies his ship "on instruments." When you have learned to piece together the story that his indicators tell, you can almost see the plane performing each graceful maneuver.

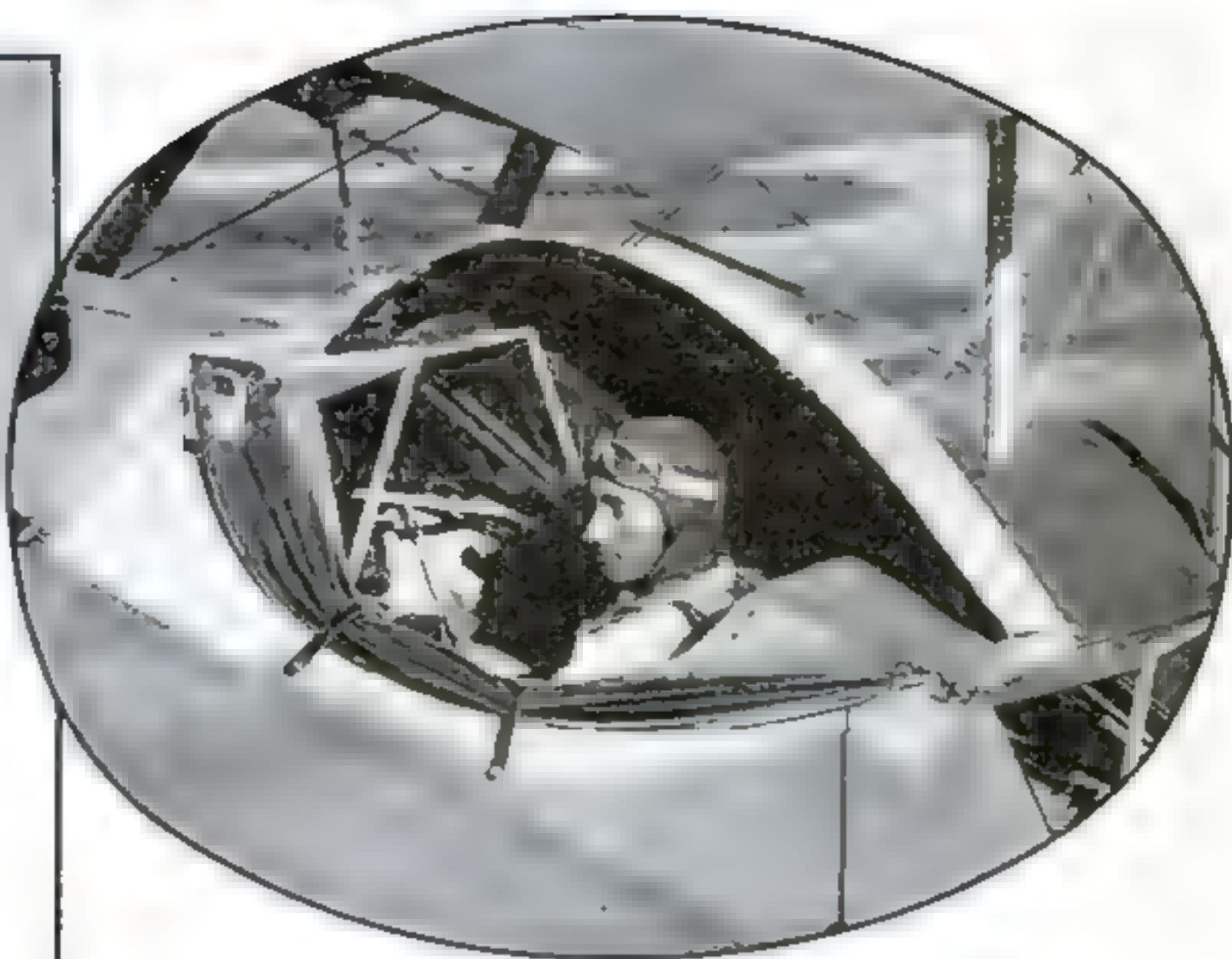
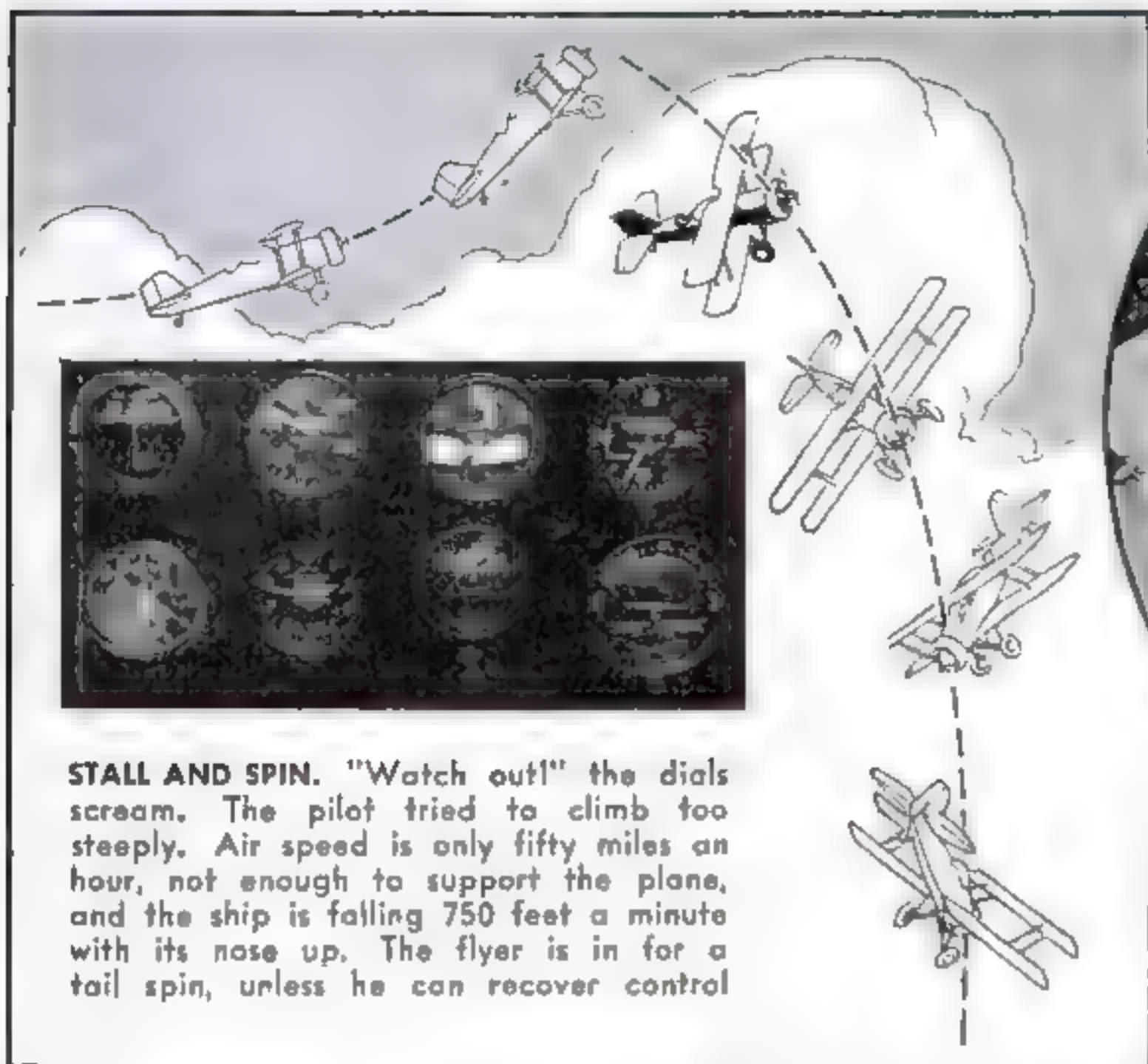
Even in clear weather, flyers rely a great deal upon the instruments shown here; in a fog, the dials are indispensable. With the earth blotted from view, human senses cannot be depended upon to tell a pilot whether he is flying straight or turning. Therefore he "steers" the telltale needle of his turn indicator (3) with his feet, operating the pedal controls of the plane's rudder to keep the needle at dead center, for a straightaway course. To stay on an even keel in forward flight, and to bank properly on a turn, he holds the steel ball of the bank indicator (lower part of dial 3) centered with sideward movements of his control stick. These motions regulate the angle of banking, through the plane's ailerons. Fore-and-aft movements of the control stick, heading the plane up or down by working its "flippers," or elevator, are reflected upon the gyro-horizon (8). This device, which also shows the angle of banking, and the directional gyro (7), which supplements the magnetic compass (1), are among science's latest contributions to the blind-flyer's instrument panel.



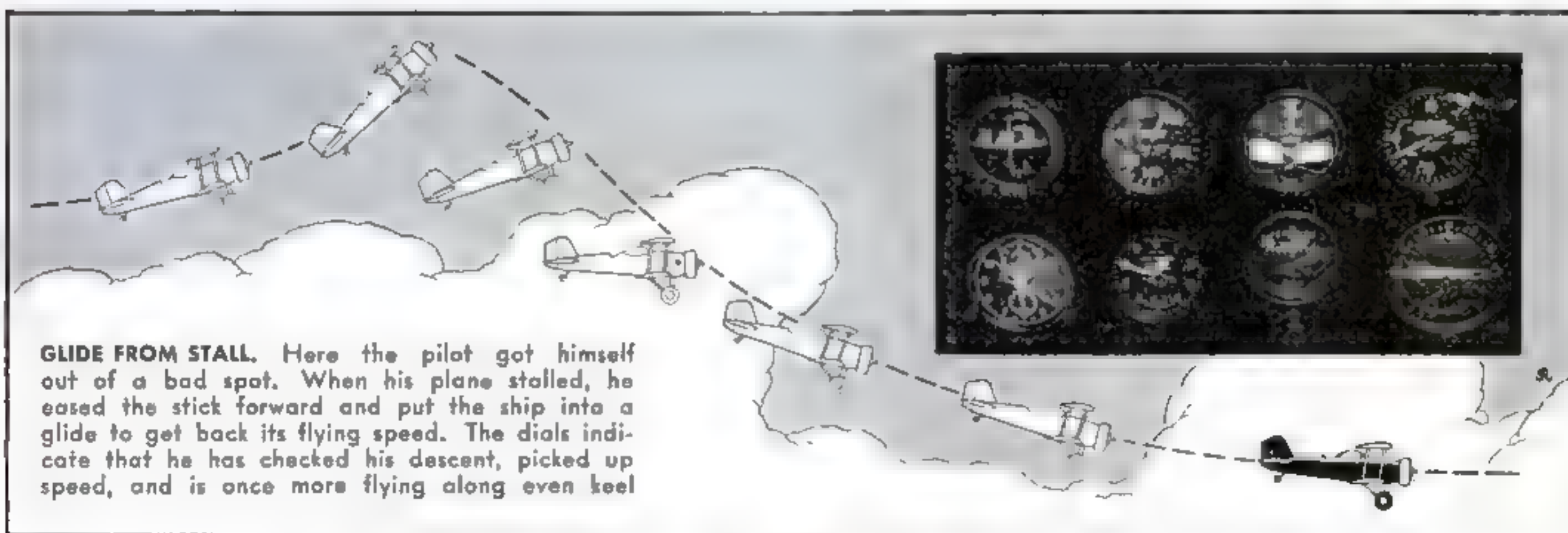
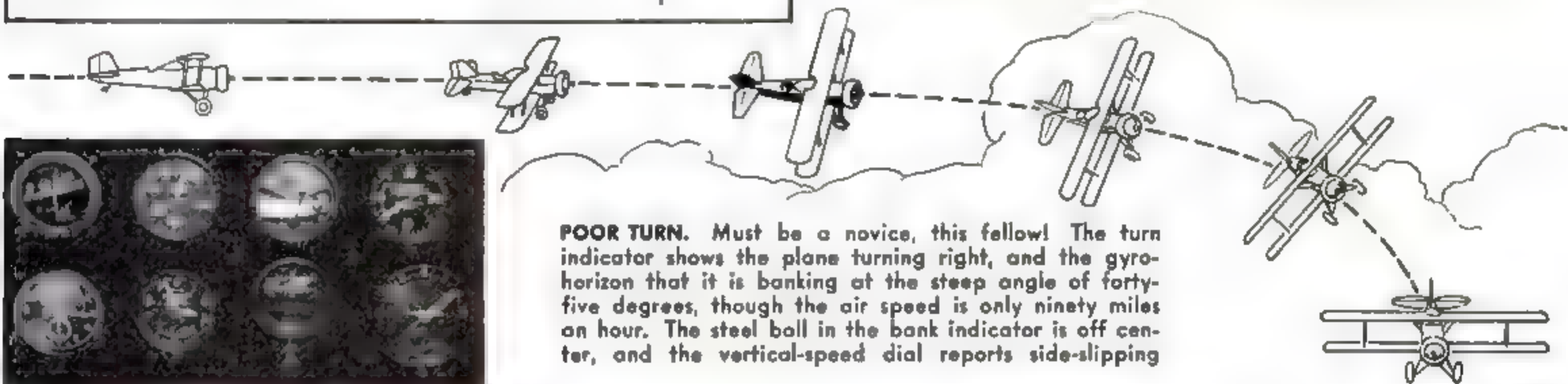
DIVE. Now we're coming down in a hurry from 2,400 feet. The panel shows the nose pointed down and the ship dropping 900 feet a minute at 155 miles an hour



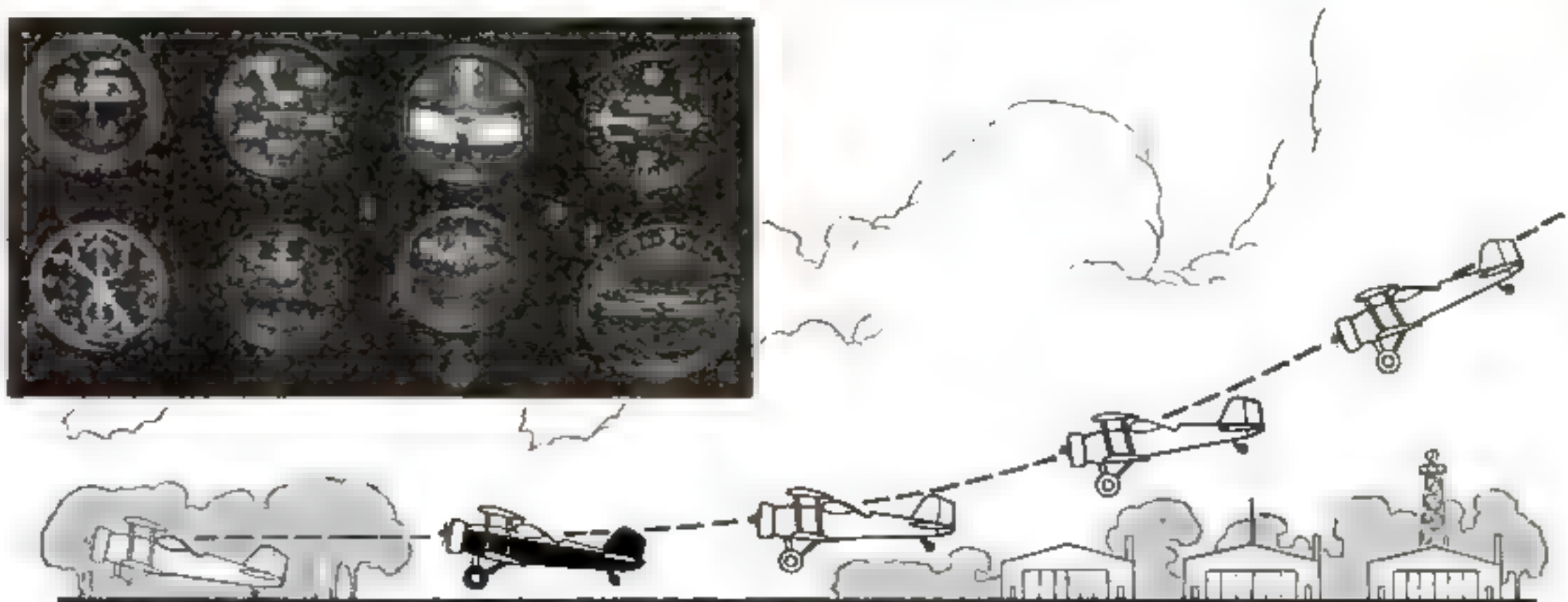
for BLIND-FLYERS

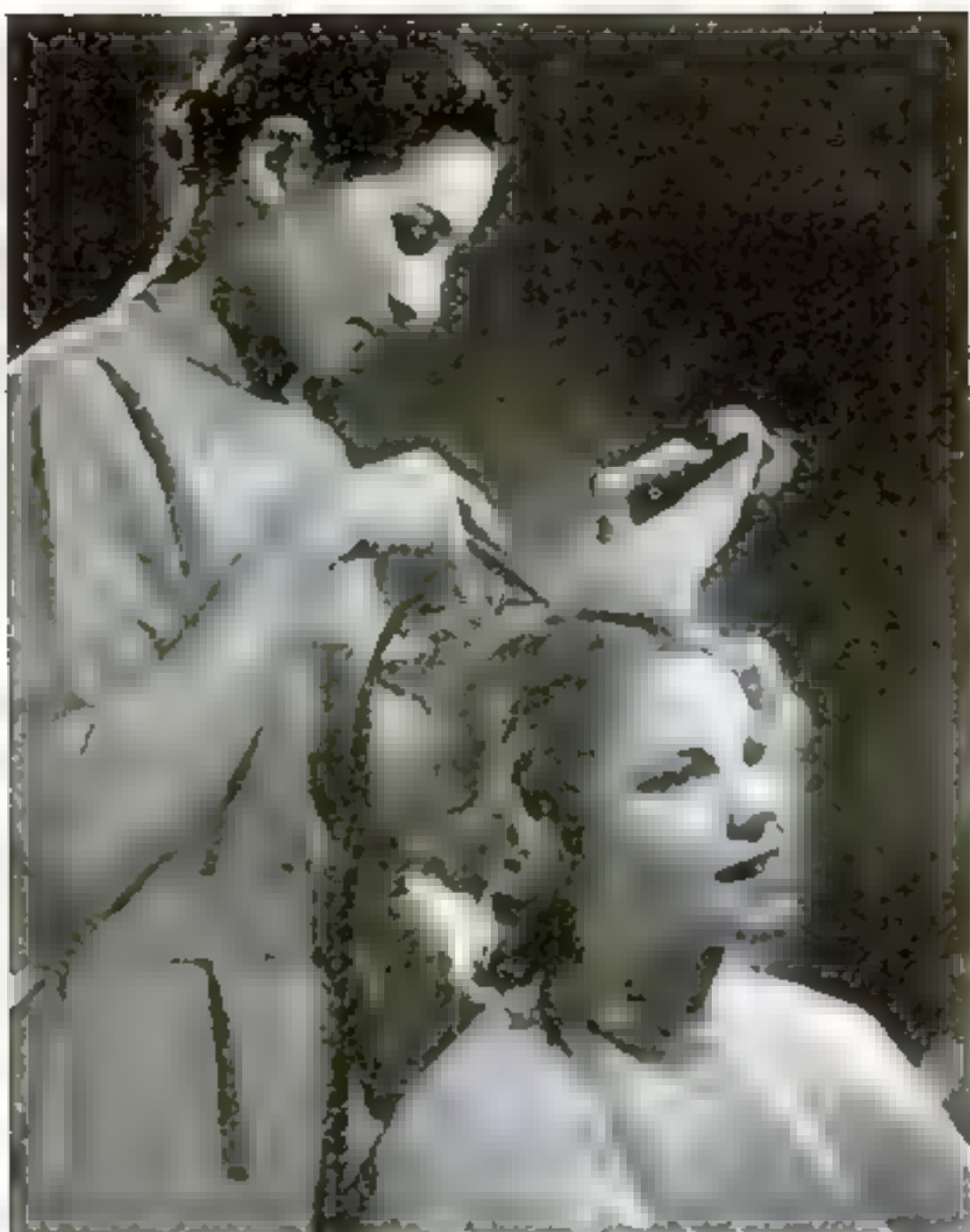


A student pilot going "under the hood" for practice in flying by his instruments. This training teaches him to read the dials instinctively and rely entirely on them



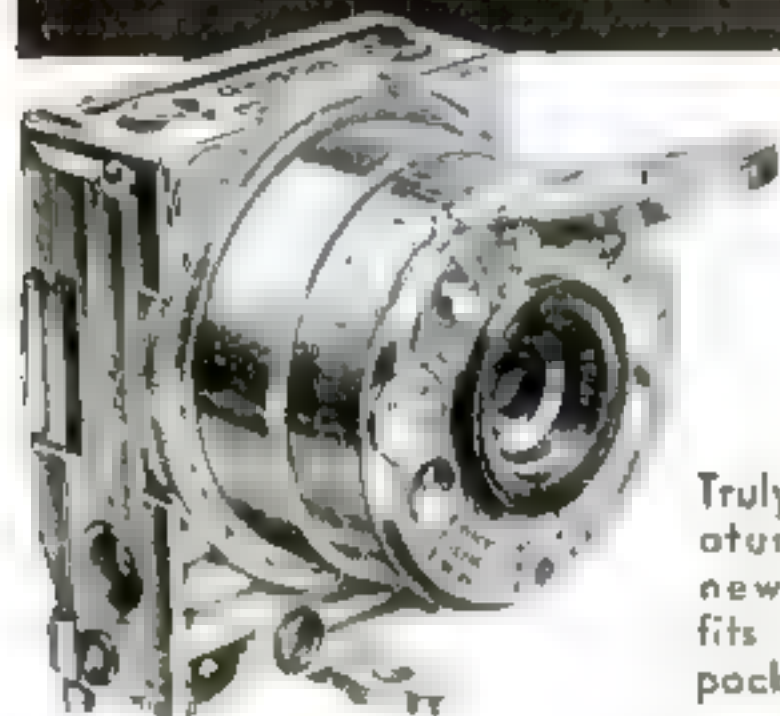
LANDING. "Getting close to the ground," the altimeter reports, and the other instruments reveal all the essentials of a perfect three-point landing. According to the gyro-horizon, the nose is up and the wings are horizontal; the needle of the vertical-speed indicator registers slow settling; forward speed is properly checked, as shown on the air-speed indicator. In a second, the wheels will touch the ground and, after a short run, the pilot will taxi the ship to its hangar and climb out—with a grateful look at the trusty dials that showed him the way to the airport





Hair Bleached or Dyed With Midget Spray Gun

OPERATED by compressed air, a midget spray gun for beauty-shop use is said to dye or bleach hair in half the usual time. Coloring material can be sprayed over a wide area or in a fine line by adjusting a nozzle control. With special attachments, the gun can be used for applying shampoos, oils, and liquid make-up.



Truly a "miniature," this new camera fits in a vest pocket easily

Tiny Miniature Camera Weighs Eight Ounces

AS SMALL as an ordinary package of cigarettes, a miniature camera just introduced by an English manufacturer weighs less than eight ounces. Equipped with an F/3.5, wide-angle lens, the camera operates at shutter speeds as fast as 1/500 second, taking pictures that measure one by one and a half inches. Built into the tiny unit are an exposure meter, color filters, disappearing lens hood, and focusing screen. Glass plates, cut film packed in special daylight-loading envelopes, or roll-film can be used in the versatile camera.

Records Aid Check-up on Police Courtesy

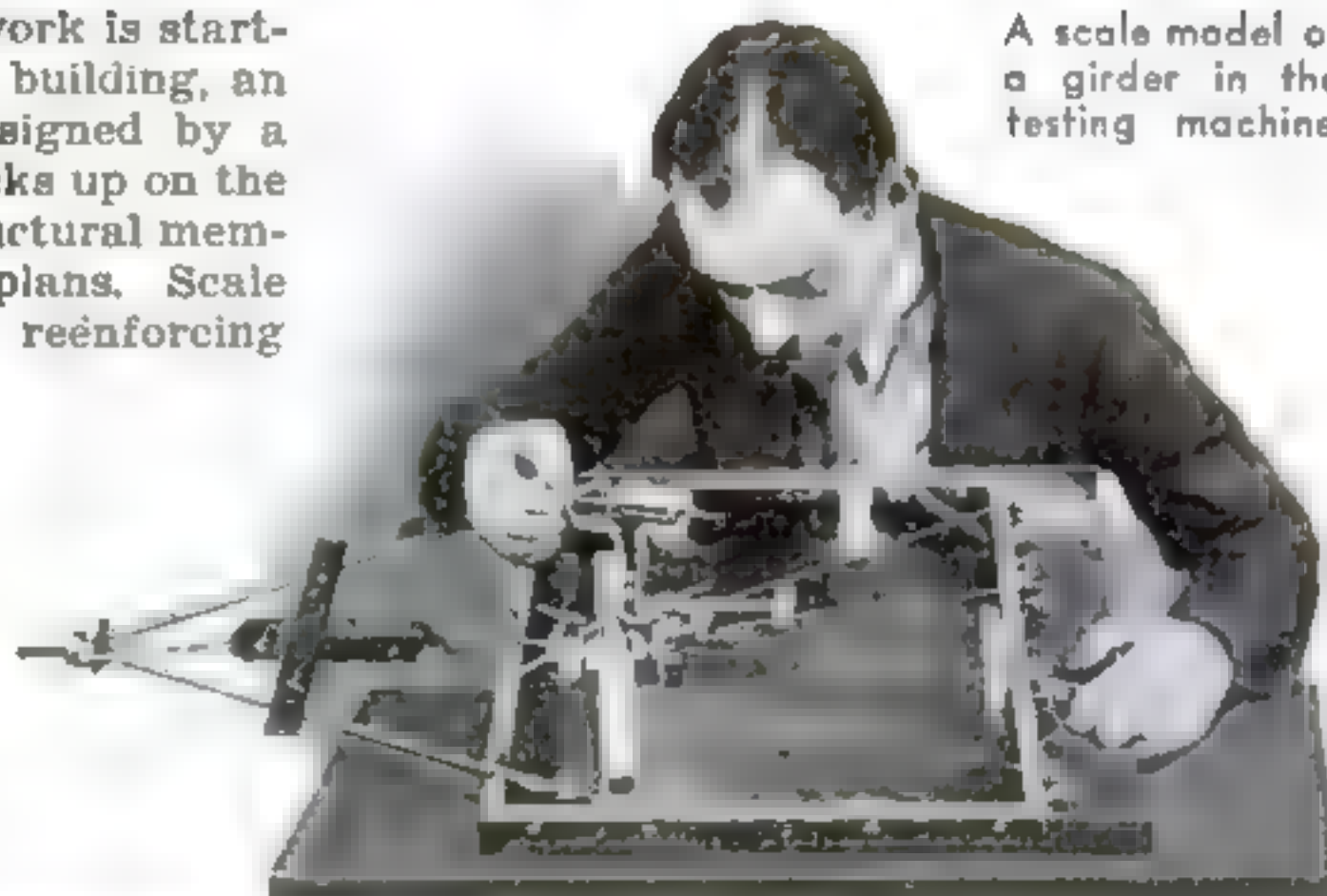
TO CHECK up on the politeness with which policemen deal with traffic violators, officials of Decatur, Ill., conceal a recording instrument in an automobile and send a driver out to get himself stopped. As a policeman makes out a summons at the car window, as shown in the photograph, his remarks are picked up by a microphone on the inside of the car door and recorded on a wax cylinder by a machine concealed in the back of the automobile. Later, the conversation is reproduced in the presence of the mayor, chief of police, and other officials.



Left, a traffic officer's remarks being recorded by a concealed instrument. Above, officials checking conversation

Machine Tests Models of Steel Structures

BEFORE construction work is started on a bridge or large building, an ingenious apparatus designed by a New York engineer checks up on the strength of the steel structural members called for in the plans. Scale models of girders and reinforcing members placed in the testing machine are subjected to stresses proportionate to those that will exist in the finished structure. The new device, it is said, eliminates many complicated calculations required by conventional testing methods.



A scale model of a girder in the testing machine



Blind workers assembling radios in a New York factory

Blind Workers Make Radios In Odd Factory

ALL operations in the manufacture of radio receivers in a New York factory are conducted by persons who are totally blind. Working solely by touch, the men match the speed of normal workers, and are said to make fewer mistakes. Each division of the factory is supervised by an inspector having normal sight.

Temple of Science Houses Huge Research Laboratory



Left, interior of a vault in which research data are kept

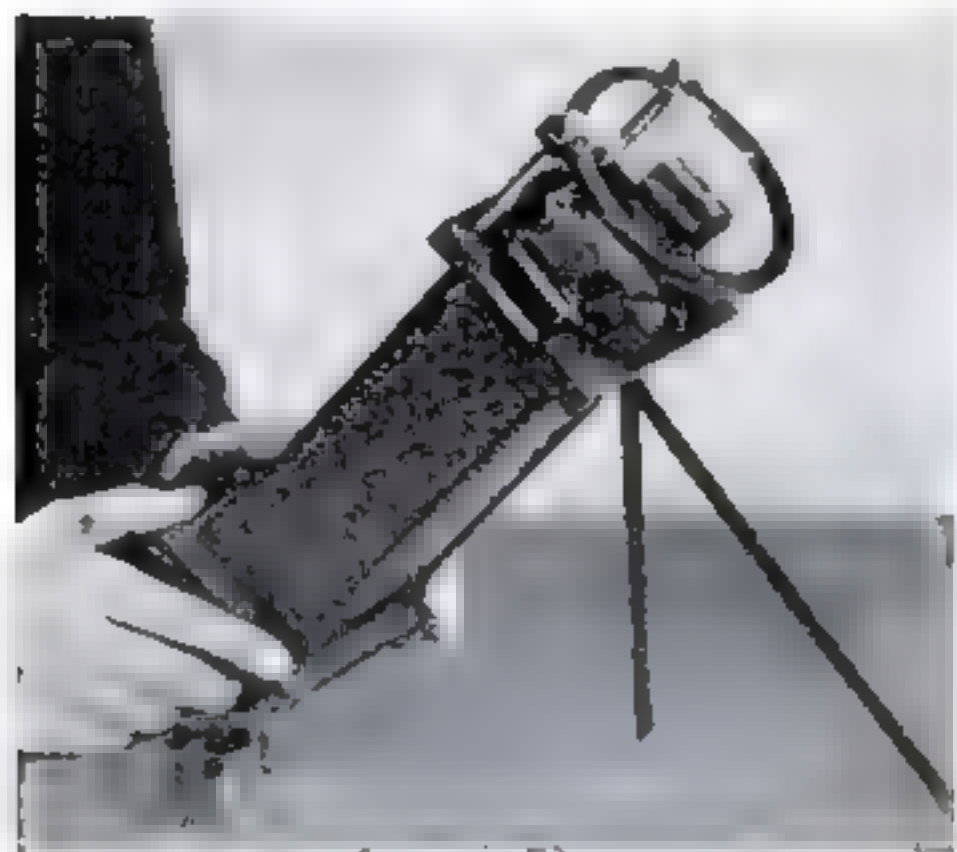
At the right is the Mellon Institute's new home in Pittsburgh, Pa. Below, drawing steam from an outlet unit



ONE of the best-equipped scientific laboratories ever constructed has just been completed in Pittsburgh, Pa., as the new headquarters of the Mellon Institute for Industrial Research. The impressive building, five of whose nine stories are under ground, contains administrative offices, fireproof vaults for storage of scientific data, insulated rooms for maintaining constant temperature and humidity, and numerous separate laboratories for research into such varied industrial products as coal, cosmetics, glass, paper, steel, and cotton. Novel outlet units, connected to a central supply system, provide hot, cold, and distilled water, steam, gas, compressed air, and electric current.

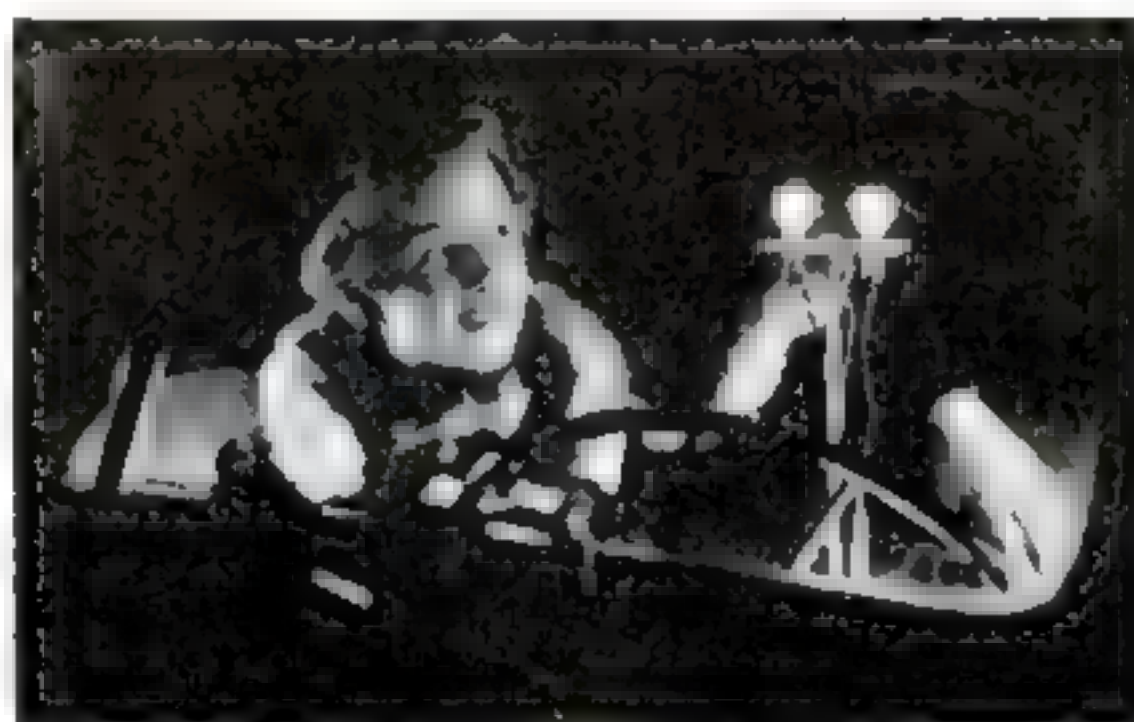
Outdoor Photo Enlarger Gets Light from Sun

DESIGNED for use by campers, explorers, and amateur photographers, a compact outfit recently introduced into this country makes it possible to produce enlargements from miniature-camera negatives without the use of a darkroom or electric lights. A magnifying lens at the top of the enlarging box concentrates sunlight on the negative in such a way that the picture on the film is thrown on a special "printing-out paper" that requires no developer. It need only be taken from the enlarger, placed in a fixing bath, and dried.



Compact enlarging outfit set up for use

Lamps Show Car Driver's Range of Vision

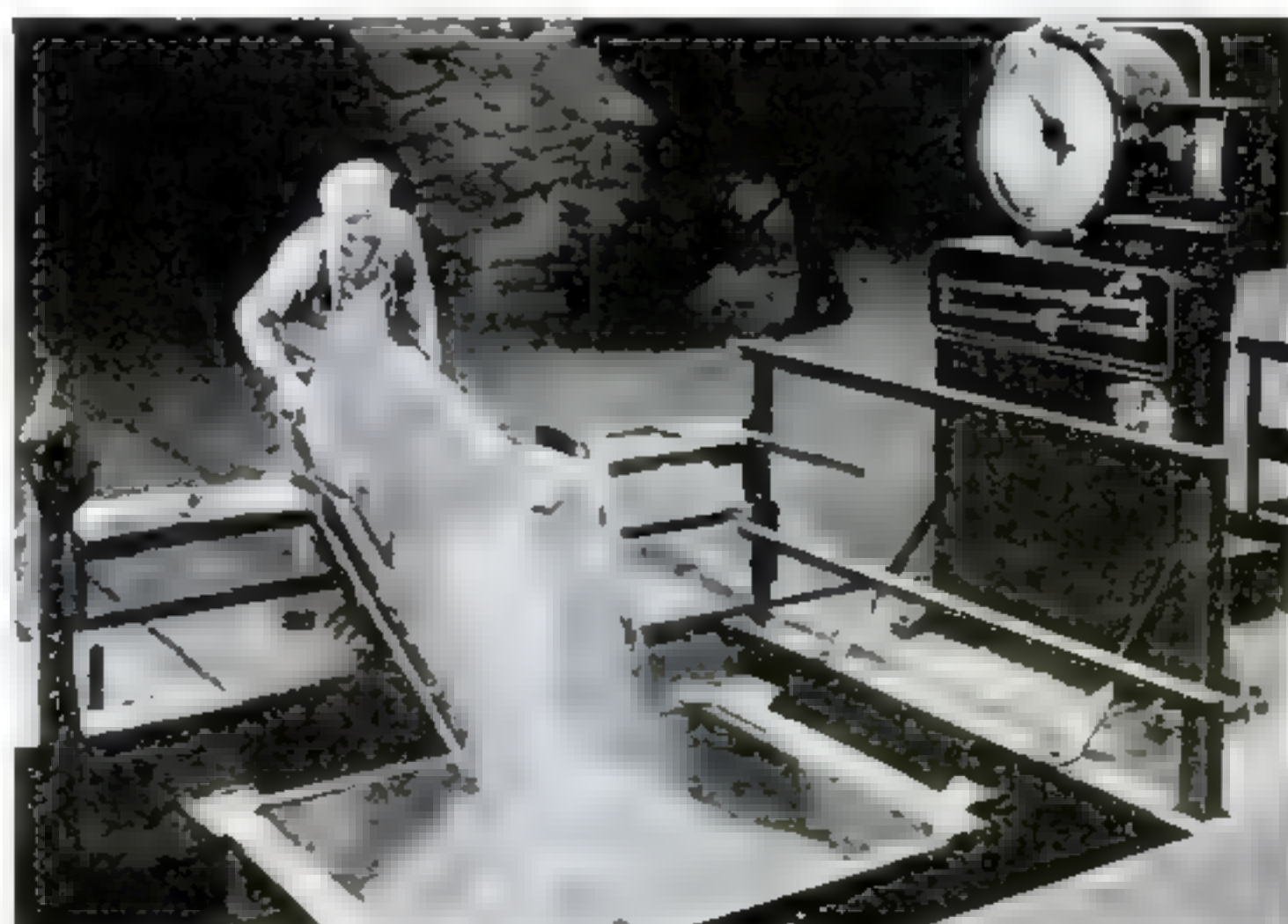


Shadows cast by lights show limits of driver's sight

ELECTRIC lamps serve as robot eyes for engineers in tests of the driving visibility of an automobile of popular make. Mounted on a stand behind the steering wheel, in the position where a motorist's eyes would normally be, the bulbs cast shadows of windshield pillars and other parts of the car body on a semi-circular wall. The shadow areas thus indicate the "blind spots" that cut down the driver's range of vision.

Mixing Scale Keeps Paint Formulas Secret

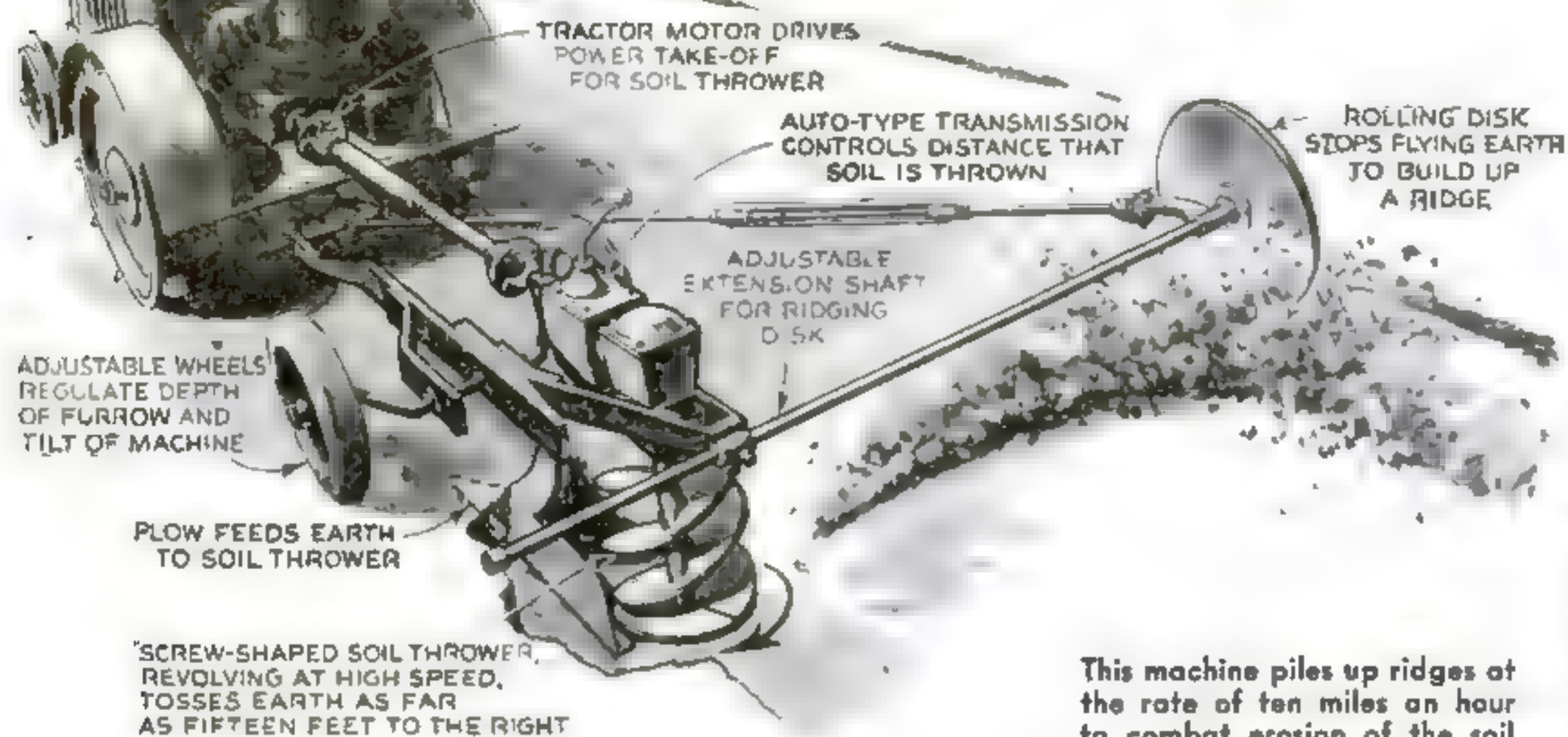
TO GUARD secret formulas, a paint manufacturing concern in Chicago, Ill., uses a weighing scale that tells employees how much of an ingredient to put into a mix without revealing its weight. Following a chart, workers pour in an ingredient until a scale dial points to a certain number, which bears no relation to weight. The actual weight is automatically stamped on a tape locked in a metal box.



Figures on the dial of this scale do not reveal weight of ingredients

Novel Farm Machine Checks Soil Erosion

CASTING the soil up in terraces to break the flow of water over sloping ground, a new farm machine helps to check erosion. Earth loosened by a short plow is caught by whirling blades which throw it to one side against a metal disk, and it falls to the ground to form a shallow ridge. The machine will form ten miles of continuous terraces in an hour.



Blades are removed through a slot at top

Razor-Blade Holder Has Spring Feed

RAZOR blades are conveniently stored in a new molded-plastic holder. A coiled spring presses a stack of new blades toward the top, where they are easily removed. Used blades are slipped into a receptacle in the base.

This machine piles up ridges at the rate of ten miles an hour to combat erosion of the soil

Miniature Jungle Scenes Made as Hobby

MAKING lifelike jungle scenes in miniature is the interesting hobby of Dr. George Childs of Brooklyn, N. Y. Over tiny wire frames, he molds plaster-of-Paris animals and birds, coloring them with diminutive paint brushes. Realistic jungle surroundings are made from bits of tissue paper, celluloid, and thread. Most of the jungle exhibits are less than two inches long.



Dr. George Childs, of Brooklyn, N.Y., engaged in his hobby of making diminutive birds and animals. The inset shows one of his creations ready for its glass cover



An image transmitted by television and projected on a screen. The lower picture shows the projecting apparatus

"Gun" Projects Television Images

CALLED an "electron gun," an experimental device recently demonstrated is designed to project enlarged television images on a conventional motion-picture screen. Operating on the principle of the cathode-ray tube now used in television, the apparatus is fitted with a special optical system which enlarges the image 2,600 times without loss of brilliancy or detail. The new projector, it is hoped, will provide an efficient means of exhibiting large television pictures in homes as well as theaters.

Abandoned Station Is Club House for Model Railroaders



Above, members try out a new turntable shown under construction at right



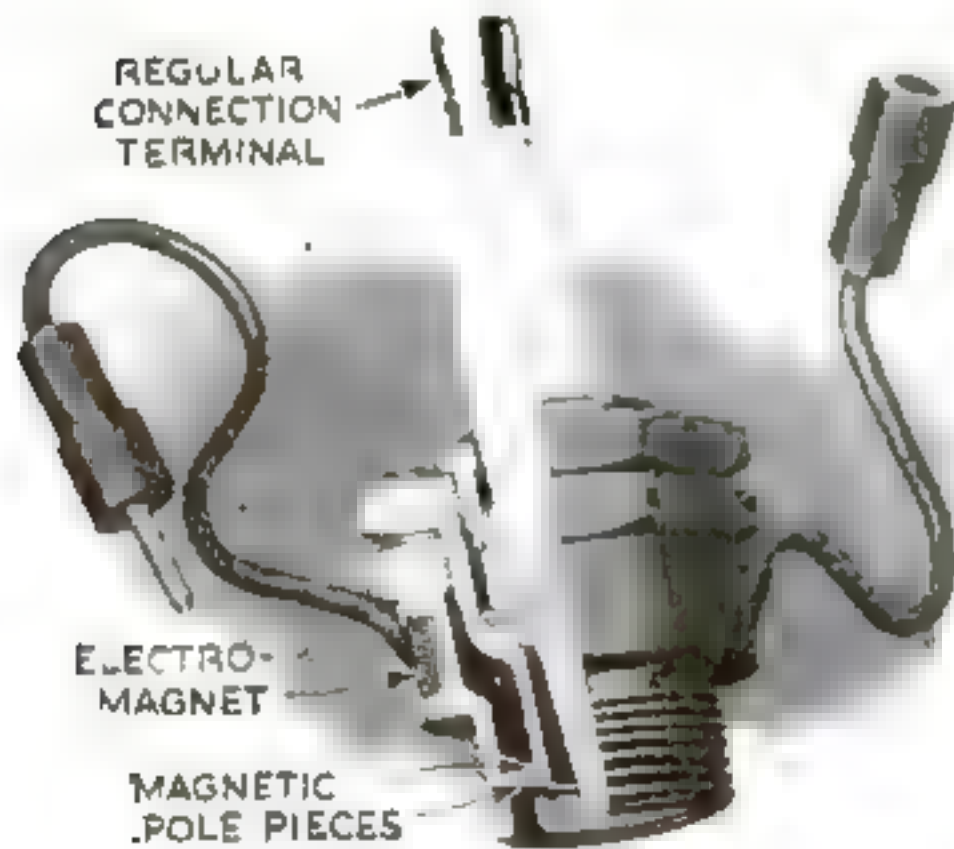
This old station sees new life as model railroaders meet in it

IN AN abandoned railway station at Pelham Manor, N.Y., model-railroad enthusiasts of Westchester County spend their spare time building miniature track and rolling stock while real trains roar past on the rails outside. The club's elaborate track layout is housed in what formerly was the main waiting room of the station, while lathes, drill presses, and other tools are operated in a shop that occupies the



old express office. Model locomotives and cars are made by hand to a scale of a quarter inch to the foot, one forty-

eighth the size of real railroad equipment, and the track consists of tiny steel rails fastened to wooden crossties with diminutive spikes. When completed, the miniature railroad will be fully landscaped with realistic rivers and mountains, and will boast a full equipment of signals, bridges, turntables, switches, and other accessories. Club members are all adults, many of them being business and professional men.



Spark Plug Has Magnet For Intensifying Arc

EQUIPPED with a built-in, battery-operated electromagnet, an automobile spark plug just invented is said to produce an arc of far greater intensity than that of conventional types. A strong magnetic field set up around the gap "draws" the spark from the electrodes and spreads it into circular form, the inventor claims, thus forcing it to occur under practically any conditions of cylinder pressure.

'Invisible' Laundry Marks

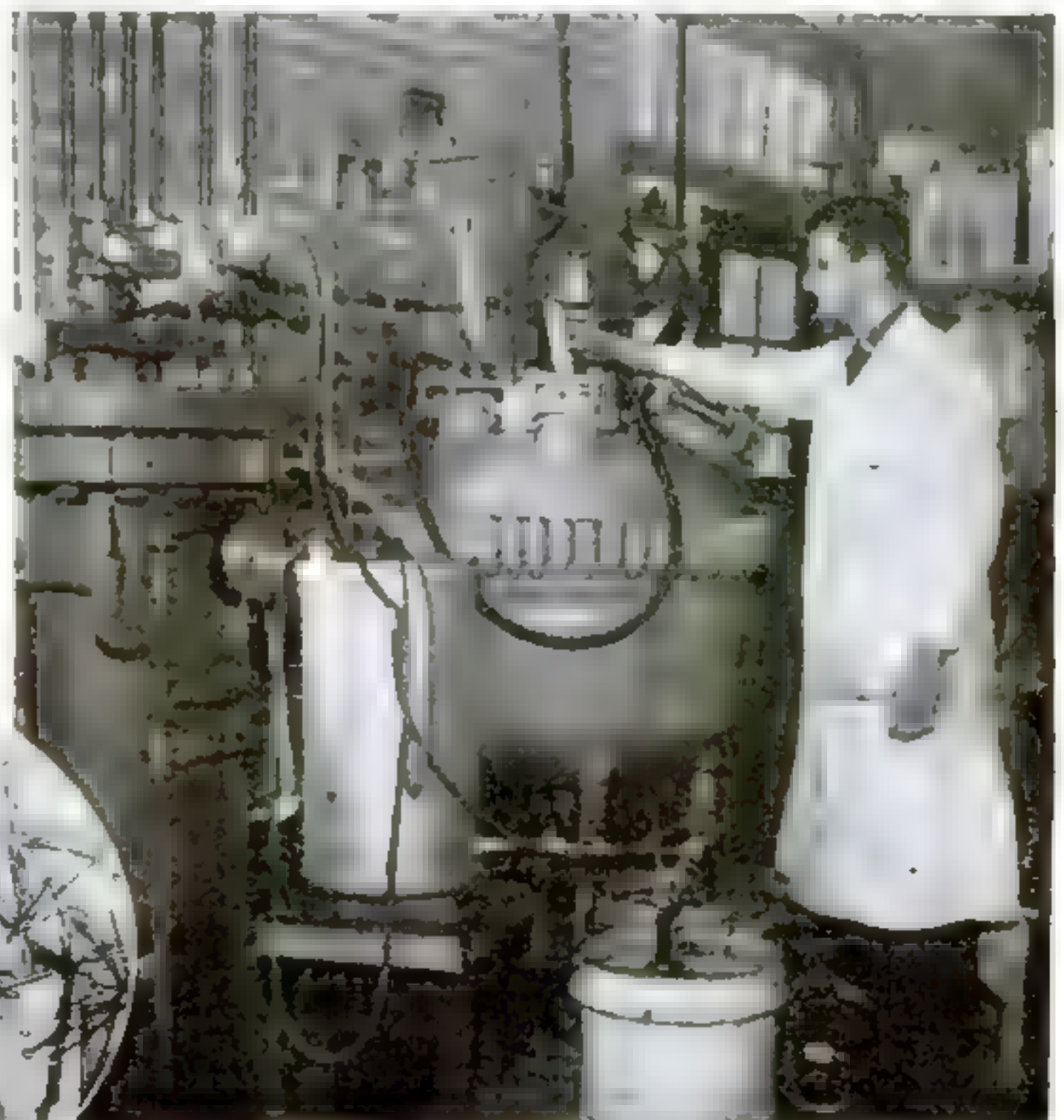
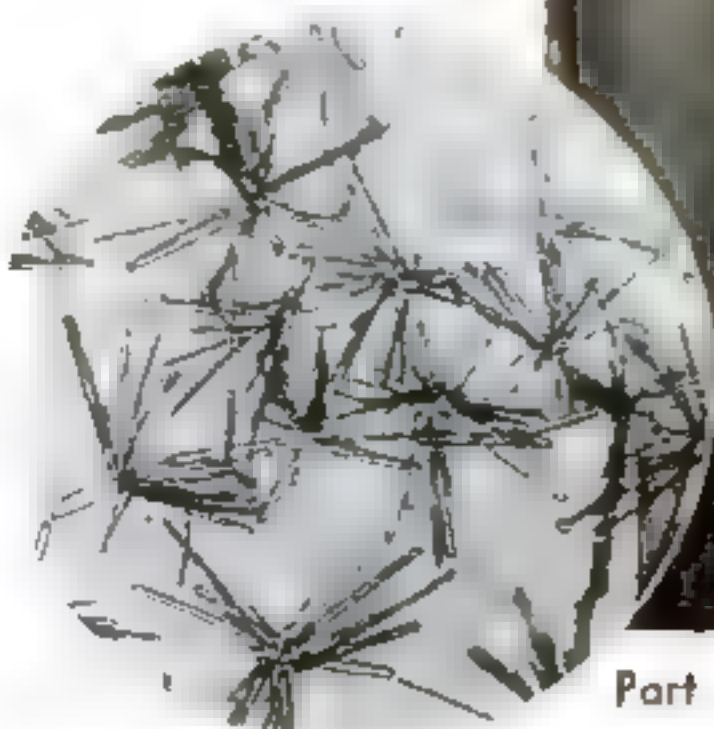
LAUNDRY marks made by a recently patented process are said to be invisible under ordinary light. A laundry using the new system stamps garments with a chemical solution whose marks show only under ultra-violet rays.

Synthetic Vitamin Crystals Made in Factory

CLIMAXING twenty-seven years of experimenting by Dr. R. R. Williams, well-known research chemist, vitamin B₁ is now being produced synthetically in laboratories at Rahway, N.J. Because the vitamin is present in certain foods only, and in very small quantities, the discovery of a reasonably priced chemical substitute is expected to prove of great medical value. The synthetic substance may be added to flour, in which vitamin B₁ is now largely destroyed by the milling process, to aid in the preven-

tion of certain types of nervous disorders, in much the same manner as iodine is added to salt to prevent simple goiter. The chemical is so potent that several doses can be obtained from a piece the size of a pinhead.

Greatly enlarged crystals of the vitamin



Part of the apparatus used in manufacturing synthetic vitamins

NOW YOU CAN Ride Your Hobby on a Train



Every week-end, trainloads of enthusiasts leave the cities to enjoy their favorite recreations with the railroads as sponsors



Passengers from a folding-boat train "shooting the rapids." At the left, carrying the collapsible craft

SPEEDING out from metropolitan centers all over the country, special trains on a dozen railroads are carrying hordes of city-dwellers into the open country to "ride their hobbies" for a day or a week-end. Summer counterparts of the ski trains that are now a familiar sight to winter travelers, the "hobby specials" mark a new and startling development in railroad-ing. Hikers, fishermen, cyclists, amateur photographers, and other hobbyists are responding in droves to the lure of fast express specials and low excursion rates.

From Buffalo, N. Y., ardent fishing fans ride a "salt-water special" to the coast of New Jersey for a taste of deep-sea fishing. New York City anglers set their alarm clocks for five in the morning to make the "fishermen's special," a crack limited train that whisks them



These people are interested in railroads, so they rode a special excursion that took them to train yards where they could examine the rolling stock and equipment to heart's content



out to the weakfish, sea-bass, and tuna waters off the tip of Long Island. On the way home, their catch keeps fresh in a baggage car equipped with individual icing compartments.

Racks crammed with bicycles fill the baggage cars that accompany trainloads of cyclists to shaded lanes and winding roads far from the noise and congestion of city traffic. You don't even need to own a bicycle, for wheels can be rented by the day for a modest fee.

This year, for the first time, boating enthusiasts rode a "folding-boat flyer" to the whirling rapids of the Housatonic River in Connecticut. A cross between a kayak and a canoe, the folding boat has lightweight wooden frames that are easily joined together with metal fittings to form a sturdy hull, which is then slipped into a covering made of seven-ply rubberized cloth. Local farmers stared in amazement as the sportsmen assembled their craft and launched them in the river's swirling currents. After an eighteen-mile run, the boats were beached, folded, and stacked aboard the train, which had come downstream to pick up the voyagers.

For the huge army of camera fans, one railroad recently ran a "photographers' special." Amateur photographers, armed with everything from simple box cameras to the most elaborate precision-built outfits, snapped landscapes and railroad rolling stock to their heart's content.

Railroads by no means forget the thousands of fans whose hobby is the railroads themselves. From Philadelphia, Los Angeles, New York, Boston, Montreal, and other cities, railroad boosters travel on special trains to locomotive factories, repair shops, roundhouses, and power stations, where they swarm over locomotives, yank whistle cords, ring bells, and demand from railroad guides the answers to detailed questions about engine construction, operation, and maintenance.

Most curious of all these trains, however, is the "lonely-hearts special" that runs out of New York City on Christmas Day. The passengers, most of whom are strangers far from their homes and "all alone in the big city," flock aboard and get acquainted with each other, while the iron road plays the rôle of Santa Claus and the train speeds along to a picturesque village where an old-fashioned Christmas dinner is waiting at a homelike inn.



What a picture! Camera fans "shoot" the track from the rear car of a train that was run for photographers

Happy anglers returning to the city after a day of sport "where the fishing is good." The day's catch is on ice in the baggage car ahead



Quiet country roads like this are the goal of the bicycle trains. You can either bring your own bike or rent one. At the left, wheels are being unloaded from the baggage car in preparation for the day's run



Emmett Dalton, world's champion jumping frog, with his proud owner after setting a mark of over thirteen feet

Jumping Frog Sets New Record

BY A leap of thirteen feet, five inches, a prize frog set a new world's record at a novel frog-jumping contest recently held in Angels Camp, California, in commemoration of Mark Twain's famous story of "The Celebrated Jumping Frog of Calaveras County." Named Emmett Dalton, the bounding amphibian is shown in the photograph above with his owner, W. G. Daniels.

Instrument Gauges Car Acceleration and Braking Speed

ATTACHED to the steering column, a new automobile instrument registers the acceleration or slowing down of a car in terms of the number of feet to the second. Incased in a bullet-shaped, streamline shell, the meter is designed to aid motorists and mechanics in checking the operating and braking efficiency of a car.



New acceleration meter attached to the steering post of an automobile



Experimental safety lanes in a California highway. The upper picture shows raised, diagonal arrows and squares of rough gravel. In the lower view, the lane is a continuous, arched strip of gravel

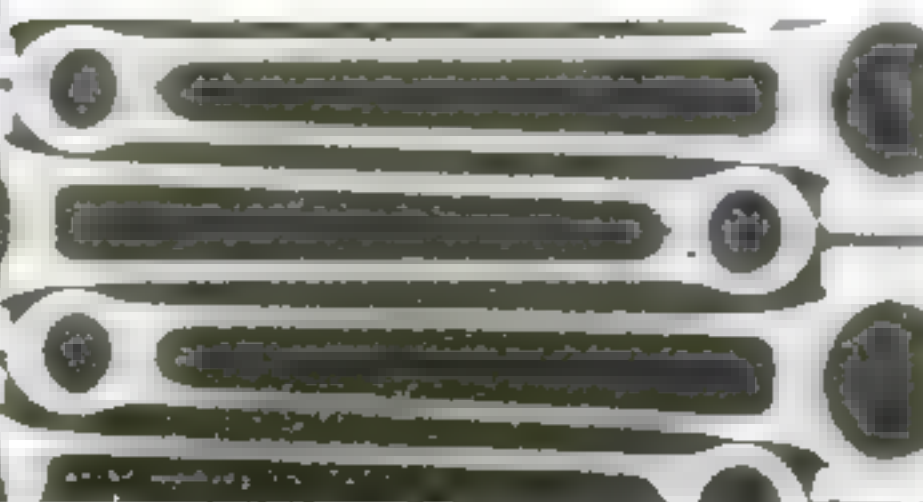
Safety Lanes Warn Motorists

DESIGNED to warn reckless motorists who do not stay in line, novel types of safety lanes are being tested by California highway engineers. In one type of lane, a raised strip of oiled gravel stretching down the center of the road is purposely made rough so that motorists will avoid driving over it. Other experimental lanes include raised diagonal arrows and rough lateral strips that jar the car.

Airplane Gets X-Ray Examination



AVIATION experts recently utilized a new portable X-ray machine to locate possible structural defects in the huge transport plane in which Amelia Earhart, world-famous woman flyer, recently crashed at Honolulu, Hawaii, while on an attempted flight around the world. Rays developed by the apparatus were said to be strong enough to penetrate eighteen inches of solid aluminum and reveal motor or framework flaws as small as one millionth of an inch. More than 1,000 X-ray snapshots were required to complete the examination.



Plana undergoing X-ray tests, and some of the connecting rods as photographed in this way



Simplified Self-Timer Aids Camera Fans

TO MAKE it easy for camera fans to take pictures of themselves, an inexpensive midget self-timer just put on the market can be quickly attached to any folding camera. In use, a plunger on the tiny device is pushed in and the timer is screwed into the camera's cable-release socket. After about half a minute, which gives the photographer time to get into the picture, the mechanism releases the plunger and snaps the shutter.



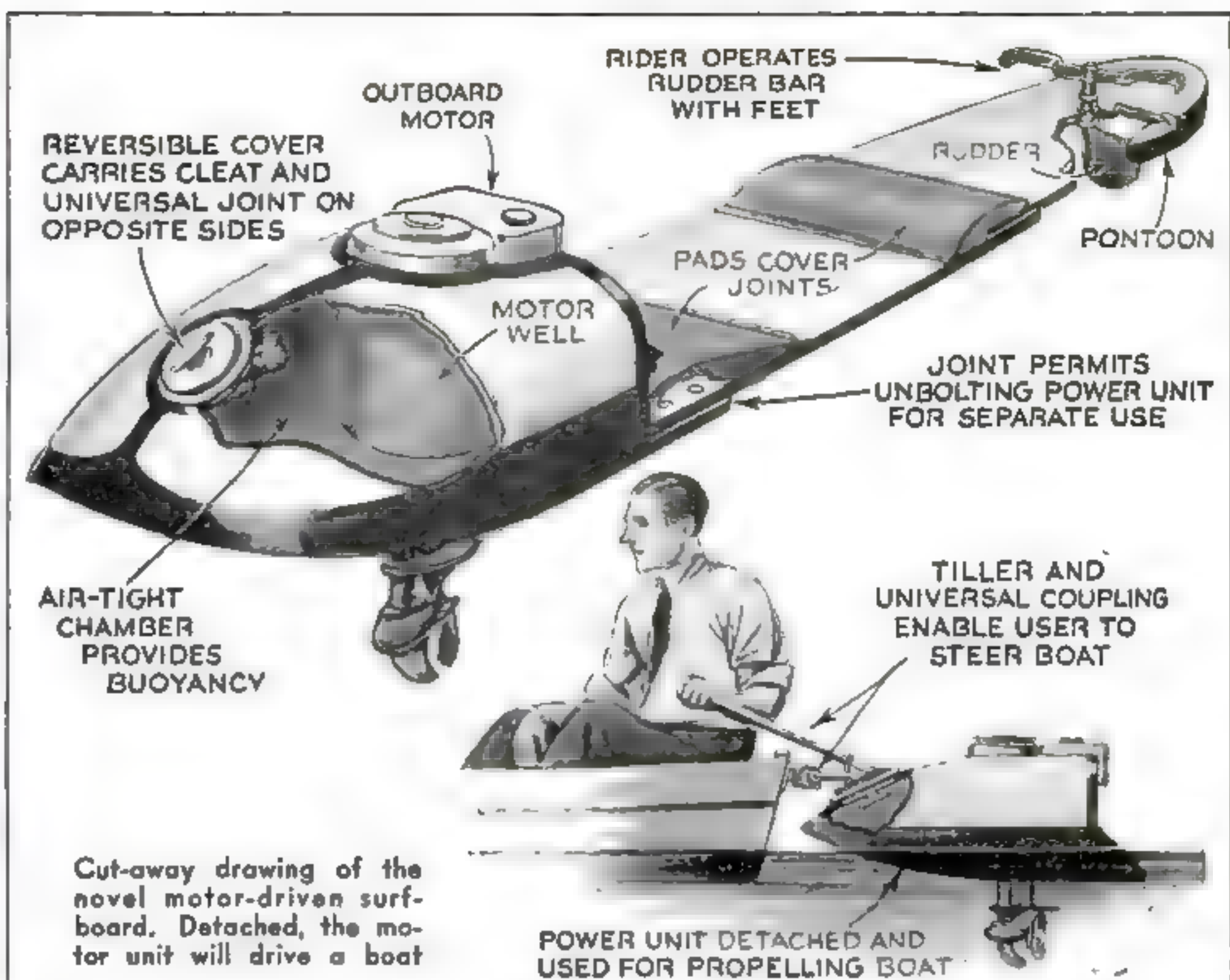
View from a liner's bridge, showing the tri-colored signal that guides ships into dock

"Traffic Lights" on Pier Guide Ship to Berth

"TRAFFIC lights" guide the movements of giant transatlantic liners when they dock at a new pier in New York City. To berth the ship with its freight and passenger ports lined up with the openings in the pier, the captain watches a three-color signal operated from the dock. Red means "go astern," green, "go forward," while a yellow light is blinked once for each foot the ship is to be moved. In departing, a red light warns river traffic that the big ship is about to leave, and a yellow signal tells the captain when it is safe to move the vessel out into the river.



A member of the docking crew operating the switch that controls the "traffic signal"



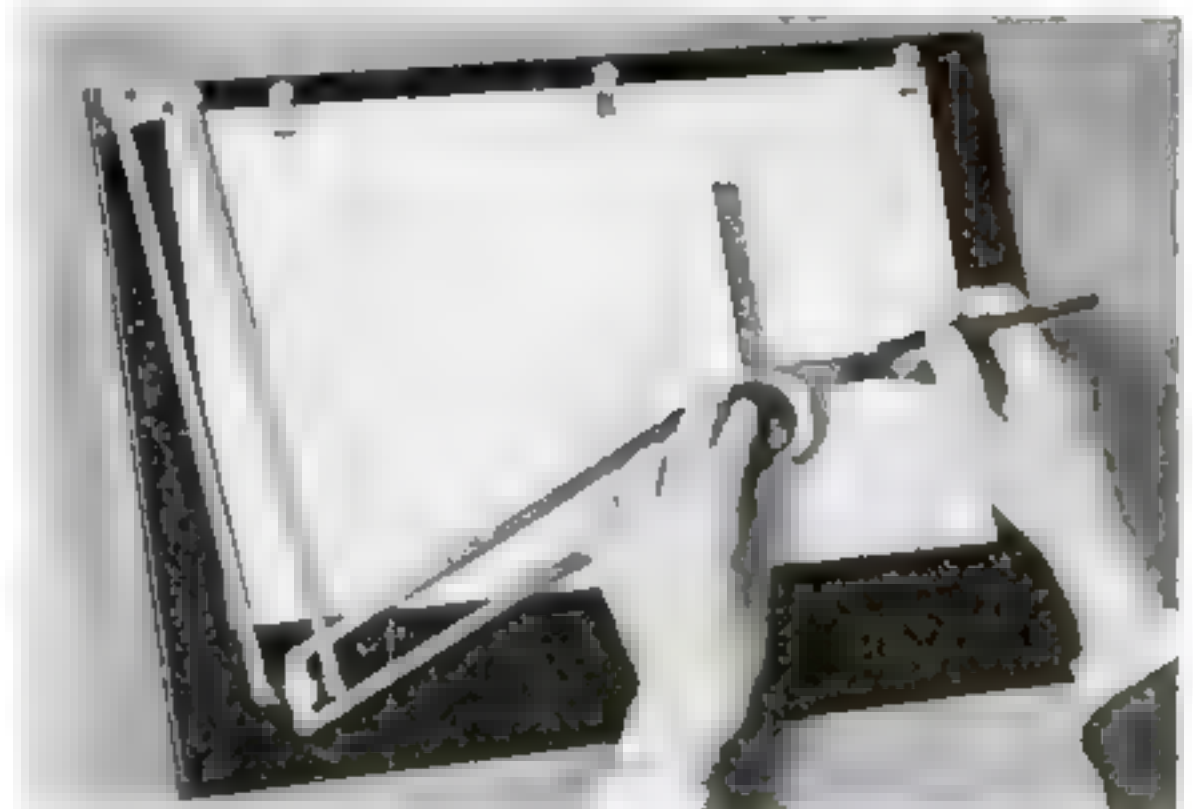
Outboard Motor Drives Novel Surfboard

SKIMMING over the water at high speed, a recently patented surfboard is powered by an outboard motor to bring the thrills of wave riding to inland waters. The motor is carried in a buoyant prow at the front of the thin surfboard, and pulls it forward, instead of pushing. Steering

is accomplished by means of a foot-operated rudder at the stern, while a pontoon at each side prevents accidental upsets. The buoyant power unit can be removed from the surfboard and used to drive any small boat or canoe, as shown in the lower drawing.

Portable Drawing Kit Fits In Brief Case

A MINIATURE drafting machine now available to engineers and artists is small enough to be carried in a brief case. Like the larger units used in commercial drafting rooms, the drawing aid provides a graduated L-square for making vertical and horizontal lines. Attached to the drawing board by means of metal arms that keep it always true, the square pivots on a protractor head for drawing angles.

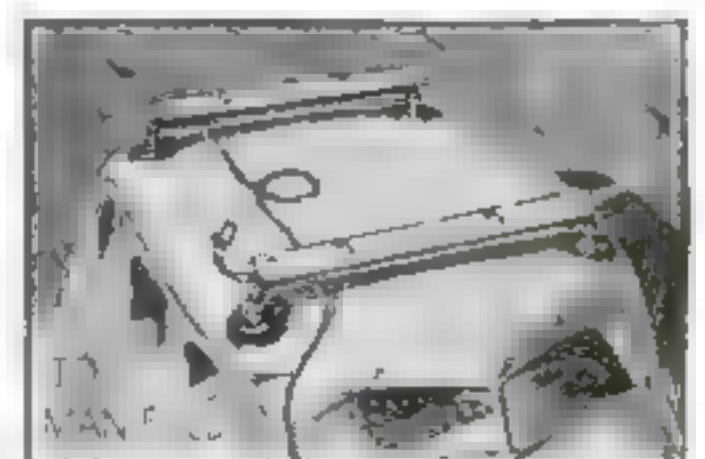
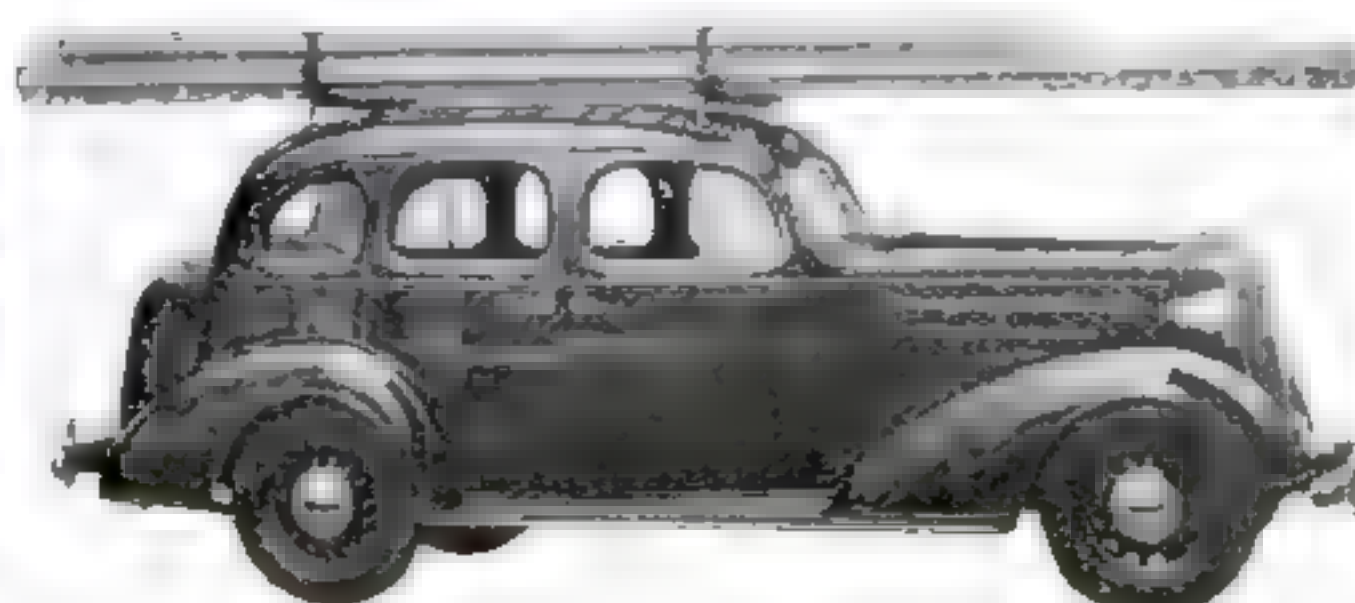


Six drawing instruments are combined in this unit

Huge Vacuum Cups Hold Ladders on Car Roof

LADDERS and other equipment are carried on top of an automobile without danger of scratching the finish by a new vacuum-cup device. Four large rubber vacuum cups support the rack

and are connected by means of a rubber hose to the intake manifold on the car's motor to obtain the necessary suction for holding the carrier in place while the car is in motion.



Left, the vacuum carrier as it looks with ladders on the rack. Above, connections to motor

Earth Put On Scales in New Tests



Left, a technician using a telescope to read delicate instruments housed in the insulated steel building that is pictured above



In this apparatus, a horizontal pendulum helps in weighing the earth

HOW much does the earth weigh? From several previous measurements, Dr. Paul R. Heyl of the National Bureau of Standards puts the figure at 6,576,000,000,000,000,000 tons, but he suspects that this staggering value may be a shade too high. Now he seeks a closer approximation by measuring the force of gravity with a special platinum pendulum swinging in a vacuum chamber. The instrument, so sensitive that it is thrown out of balance when anyone approaches it, must be observed through a telescope from a point eighteen feet away. A small heat-insulated building keeps the surroundings at the required constant temperature for the tests.

Blind Runners Follow Wires In Novel Race

BLIND runners now race in track meets with the aid of chest-high wires strung between the running lanes from posts back of the start and finish lines. Each contestant grasps a metal ring which slides along the wire, as shown in the photograph at the left. Thus the sightless racers can effectively guide themselves and avoid the danger of running off the track or colliding with one another.



Metal rings slide along wires to guide sightless athletes as they run



Skidproof Shoes for Yachtsmen

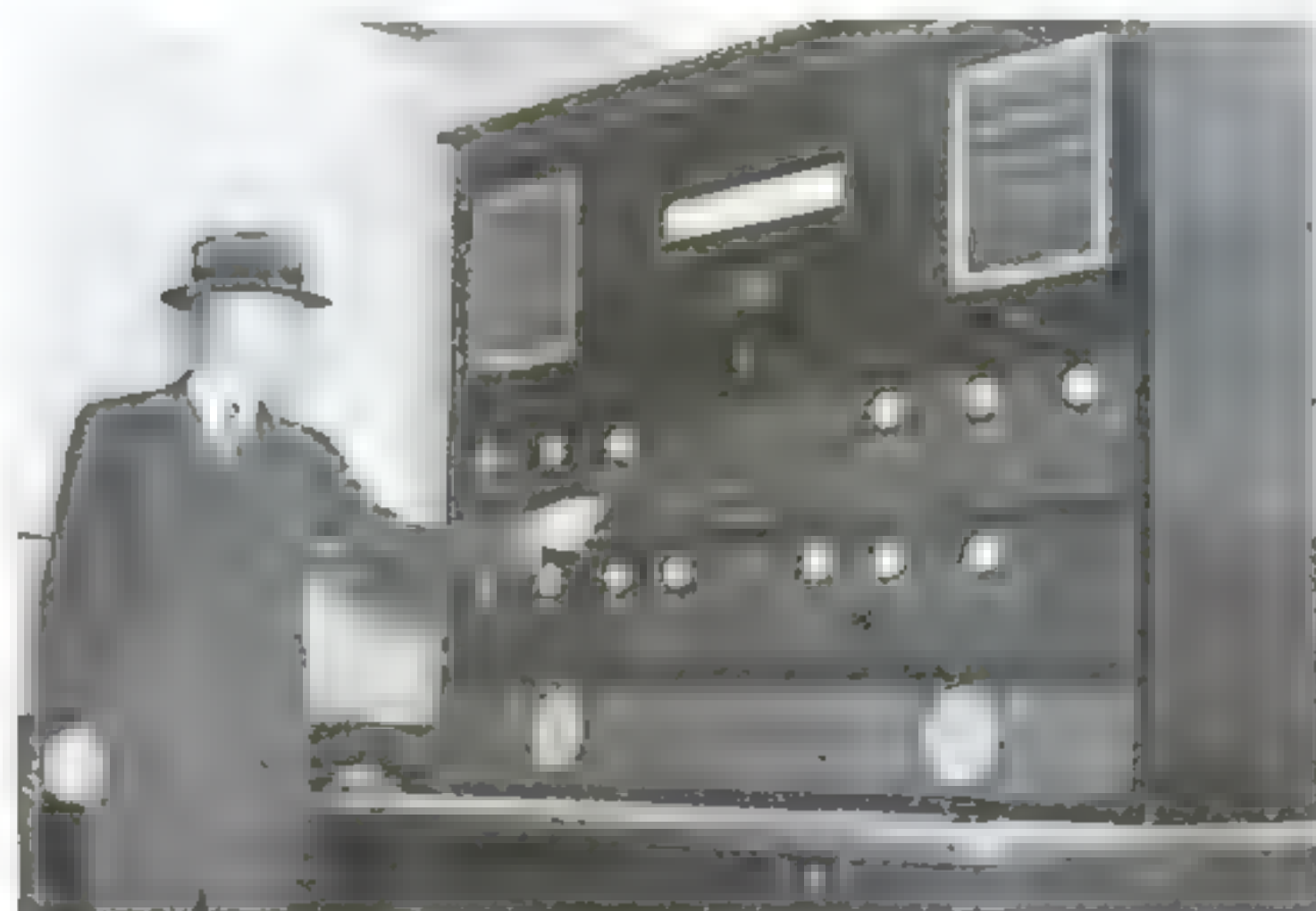
HUNDREDS of tiny zigzag cuts on the gum-rubber sole of a new shoe designed for yachtsmen are said to make it skidproof even on wet, slippery decks. Slight pressure on the sole opens the cuts to create suction and provide a squeegee action that prevents slipping.

Clock Won't Stop for Earthquakes

REGULATED by a tuning fork instead of by an ordinary escapement, an earthquakeproof clock developed at the Seismological Laboratory of the Carnegie Institution in Pasadena, Calif., will continue to run during earth tremors, to time seismographic records.

Alarm System "Listens" for Robbers

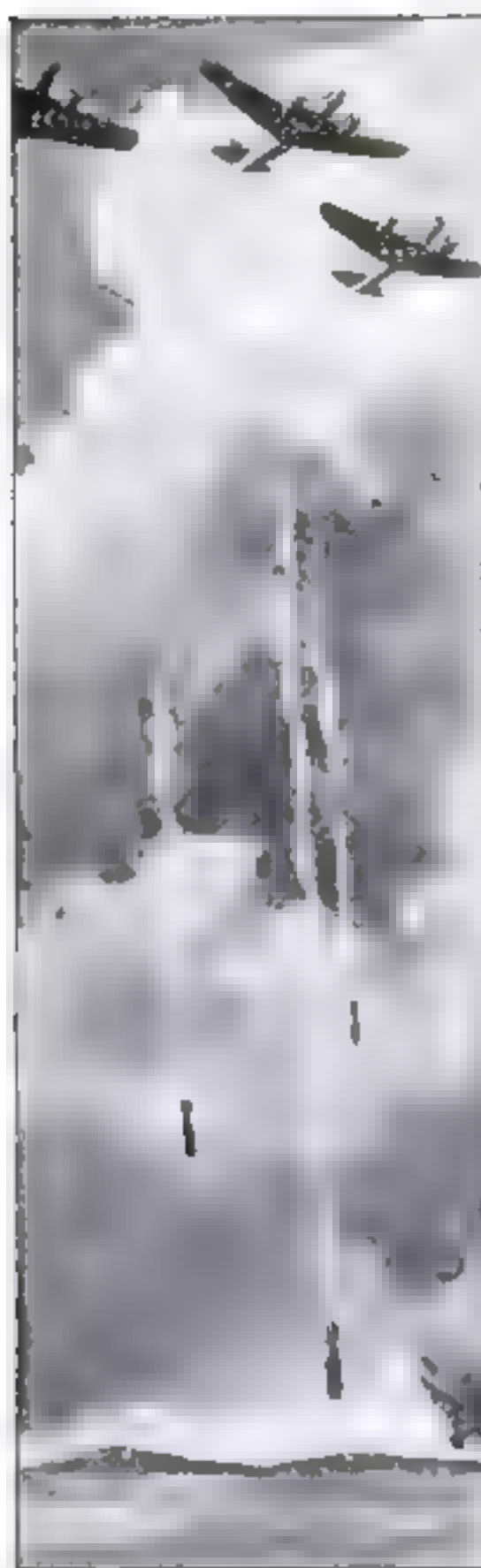
VAULTS in the new U. S. Mint at San Francisco, Calif., are protected by one of the most elaborate alarm systems ever installed. When the vaults are locked, sound detectors react to any disturbance to set off the alarms, which automatically notify police and military authorities by short-wave radio, snap on brilliant floodlights, ring alarms, and spray tear gas from concealed jets.



Automatic control board of the alarm system for vaults in new U. S. mint

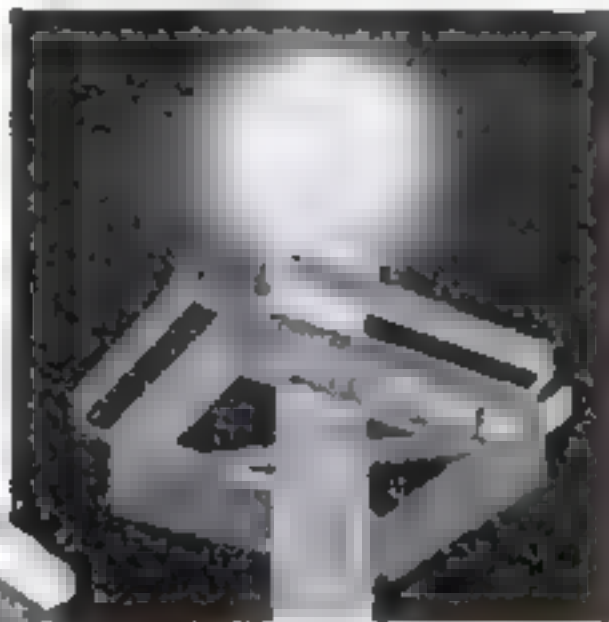
Smoke Traces Dummy Bomb

WEIGHTED with sand and water, dummy bombs used for target practice by U. S. Army airplane pilots are now charged with chemical smoke cartridges. When a bomb is released, smoke trails from its tail as it hurtles to earth, enabling the pilot and official observers to check the path of its flight. The weight of the sand and water causes the projectile to leave a conspicuous mark at the spot where it lands so the accuracy with which the bombs were dropped may be checked.



A ground crew placing bottles of smoke-producing chemicals in dummy aerial bombs

Mirrors reflect light from lamp onto the signs



Mirrors Light Street Signs

BECAUSE street signs in Buffalo, N.Y., were not clearly visible at night, rectangular mirrors have been installed above them. Rays from the lamp globes are reflected onto the street designations.



China's Huge Iron Lion Explained

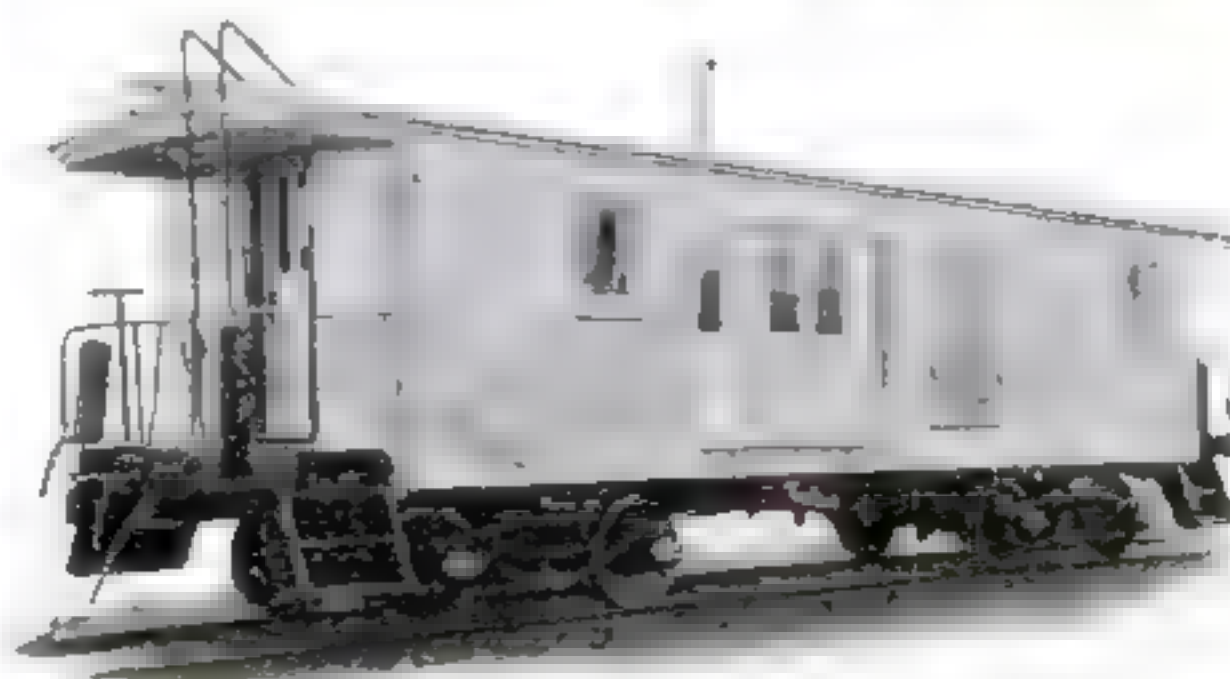
THREE times as tall as the average man, the colossal statue of a lion shown in the photograph at the right is believed to be the largest iron casting ever made. All in one piece, the iron figure was erected in China almost ten centuries ago, 500 years before iron casting was developed in Europe. According to a study made by Prof. Thomas T. Read of Columbia University, New York City, the lion was made in much the same way as a modern concrete building—by erecting molds or forms, and casting it in sections.



This huge figure of a lion was cast in China 984 years ago

New-Style Caboose Has Bay Windows

Views of interior and exterior of the new caboose. Note bay windows at sides



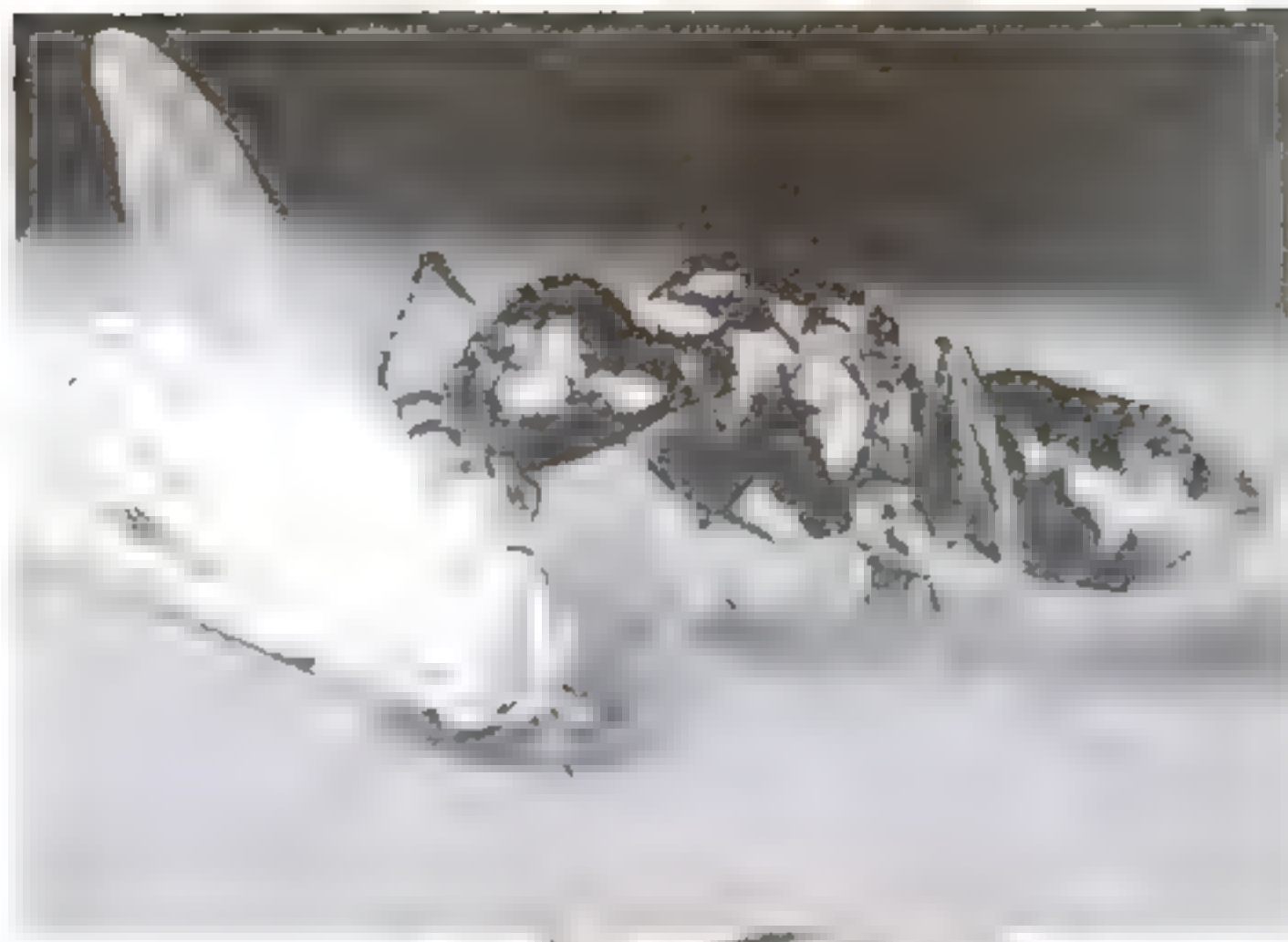
INSTEAD of the familiar "dog house," or cupola, a new type of freight-train caboose recently put into service on a western railroad has a bay window on either side, from which trainmen can look along the length of

the train while sitting in comfortable coach-type seats. The new cars are covered with aluminum paint to reflect the heat of the sun, and are fitted with benches that also can serve as comfortable couches.



With a hand lens used as shown at the left, sturdy citizens of an artificial ant nest can be observed at their work and in the fascinating details of ant life

In the close-up at the right, a carpenter ant is seen tugging at the body of a horsefly. If he finds it too much of a load, he may send out an SOS to get some help



A queen ant (with wings) and a worker holding a conference by touching their antennae



MAKING A NEST
The final step in the construction of an artificial nest—binding the edges of the glass plates with tape. The drawing below suggests dimensions

FULL
HALF-WAY
MARK
W. H. SAND

THICK
STRIP

ETT
AT 7.00

BIND EDGES AND
TOP WITH
FRUIT ON TAPE

WHAT I LEARNED

Spying on ANTS

THE most marvelous atom in the world, except the human brain." That's what Charles Darwin said of ants. "Brainless automatons," answered Bethe, the German scientist. "Go to the ant, thou sluggard," commanded Solomon. "His vaunted industry is nothing but busybodyness," scoffed Mark Twain.

Whatever the ant is, he is not as human as his behavior would lead us to believe. Some otherwise reliable observers have not blushed to tell fanciful tales about ants marching in regular platoon formations, obeying ant generals and captains. The wonderful things that ants really do accomplish, the human intellect tries to explain as ant intelligence comparable to ours—the idea being that ants couldn't be such smart little people if they weren't like you and me!

But the truth about ants is more startling than the fiction. Tropical ants

do go on irresistible marches, and roll themselves into great balls at night; others sow, cultivate, and harvest certain fungi in regular mushroom cellars. The vaunted "queens" are actually prisoners, scarcely more than egg-laying machines. Actually, ants have something like a communistic "totalitarian state," and the penalties they pay for it in the loss of individual initiative are thought-provoking.

I wanted to see some of this for myself, and so did my little boys. Ant houses, or glass observation nests, can be bought now ready-made from many dealers. However, since I didn't know where to get one, and probably wouldn't have had the price anyway, I made one for myself.

It was easy and cheap. At the hardware store I had two sheets of thin glass cut, measuring twelve by eighteen inches. Three narrow strips of glass, about a quarter of an inch thick, were laid flat to separate the larger sheets along three sides, leaving one short side without a glass wall. Then I passed adhesive tape around the sides and folded it over the top and bottom to bind all together, closing it over the open side last of all. This end of the tape can then be peeled back to fill the nest with sand, and later to let the ants in and out, or to add food or water.

I filled the nest only half full of sand and placed my ant house flat on a table, the legs of which I set in shallow saucers of water.

Now to catch the victims! Medium-sized species are best. My little boys trudged out with me, holding a bag ready. Into this I swiftly shoveled every bit of an ant nest I could get up in a few deep spadings. Excitedly the children clenched the neck of the bag shut and we took it home, laid it on the table, and then cut it open and spread the sand out thin so it would



Sand is poured into the nest through the open edge, as seen at left. Below, capturing prospective residents by scooping up natural ant nests into a large paper bag

Ants keep "cows." At the left is seen a herd of aphids, or plant lice, being driven to pasture. When stroked, they yield drops of sweet liquid



dry. The disgruntled little citizens stormed around a while, but finally entered the artificial nest because it was damp (ants soon die in dry earth) and dark, as I wisely kept the top covered with black cloth. Ants hate sunlight, so the dark cloth should stay on all the time the creatures aren't actually being spied upon. When sealed, the nest may be moved about.

My first venture wasn't a complete success, because I had not secured the queen and her offspring. Without them, ants see no point in existence, and their habits become desultory; many even die without apparent cause when their occupation is gone. So I went back and carefully dug up the queen, which I knew by her enormous size as compared with the others. I also got a lot of winged drones, or male consorts, and plenty of ant eggs (or what are so called; they are really pupal cases, corresponding to the chrysalis stage of butterflies). Ant larvae are tiny grubs, and the true ant eggs are little pearl-like specks. I secured some representing all stages and, playing Santa Claus, made my household colony wildly happy by dumping all these delights out of my second sack.

When playing the all-seeing eye to ant civilization, most people look for two phenomena that are, actually, out of the ordinary in normal ant history. These are, first, the slave-making tendencies of a few rather rare species, and second, the sensational combats between enemy species. It is true that the worst enemies of ants are ants, as men are the most dangerous foes of men, but international scraps are much less frequent than desperate competition between ants of the same kind. Only certain very predatory species invade one another's nest much. Most ants prefer a peaceful existence, and though you can play Nero in your homemade Colosseum and force fierce gladiatorial combats on your guests, the result is as confusing as it is destructive to your own labors.

The normal life of an ant nest is more fascinating than any bloodthirsty battle scenes. Watch your sturdy little citizens fall to and excavate streets and tunnels, storerooms, sanitary "tanks," royal chambers for the queen, and nurseries for their children. See how they care for their young, literally "touch" one another for a bit of food, cere- (Continued on page 120)



When ants are turned loose on a table, saucers of water under the legs will prevent escapes

By DONALD CULROSS PEATTIE

Through the Glass Walls of
a Homemade Artificial Nest,
the Author Saw for Himself
Some of the Strange Doings
in a Lively Insect Village



An experiment in ant communication. The nest is placed on one table and food on another, with a paper bridge between. An ant is crossing the bridge to the nest to report her find



Stainless-steel boat built for exploration in Alaskan waters

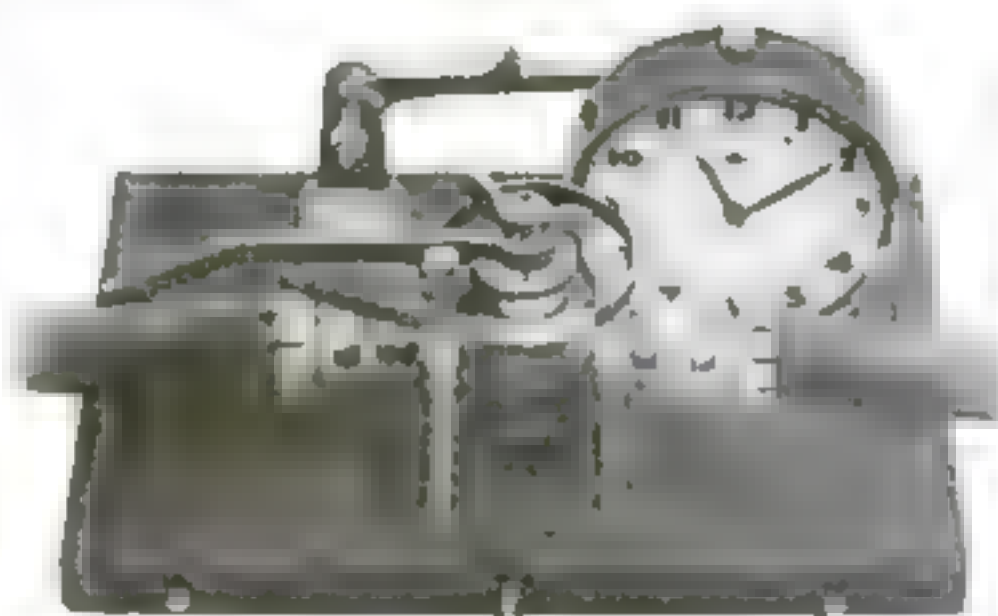
Stainless-Steel Boat Braves Arctic Ice

MADE entirely of stainless steel, a motor launch built for Arctic exploration is designed for rough use in ice-clogged seas. Believed to be the first of its kind ever built, the all-metal boat was recently tested off Seattle, Wash., prior to its de-

parture for an expedition to Alaskan waters. Its owners expect it to be safer and require less attention from the standpoint of maintenance than the conventional wooden boats previously used for work of this kind.

Alarm Clock Turns Hose On or Off

UTILIZING an ordinary alarm clock, a new device automatically turns a lawn sprinkler or garden hose on or off at any predetermined time. The alarm mechanism of the clock releases a spring-operated lever which turns the valve to the desired position. A simple adjustment made by means of a thumb screw sets the device for turning on or off, as the case may be.



Clock releases lever to open or close valve



Inventor with model of improved acoustic altimeter

REGISTERING height above the ground instead of altitude above sea level, acoustic altimeters may soon be available as safety equipment for airplanes. This type of instrument, which operates by measuring the time required for sound waves to travel to the earth and return, has hitherto been impractical for use in heavier-than-air craft. In the improved model, being perfected by Lieut. Leo P. Delsasso, U.S.N.R., calculations are eliminated by recording the elevation directly on a dial.



Giant Backgammon Set Used Outdoors

BACKGAMMON enthusiasts play the game on a large scale with a novel outdoor set just introduced for use at beaches and other resorts. A huge, marked

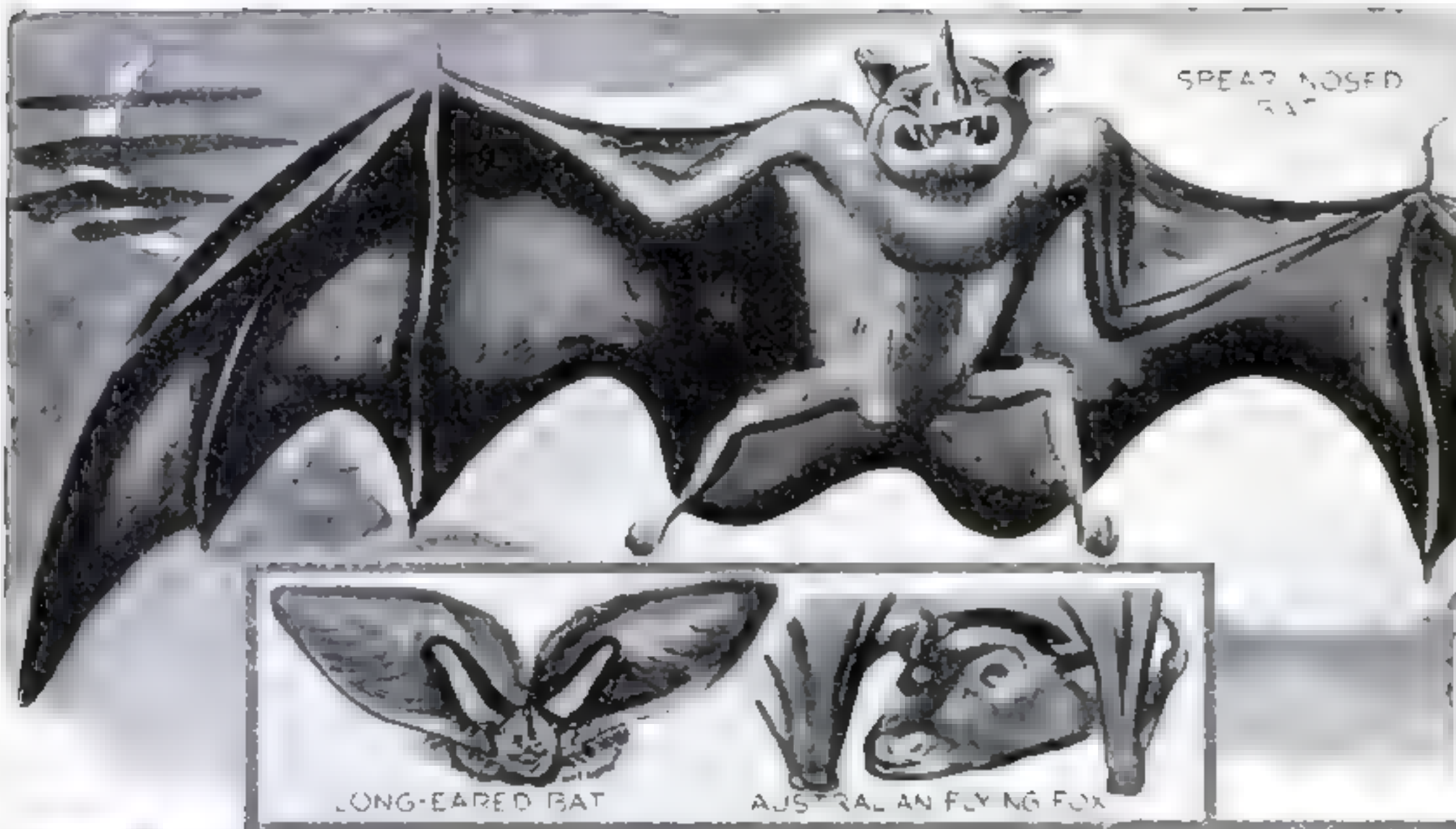
cloth is spread on the ground as a playing "board," and the contestants move counters with long wooden poles according to the numbers appearing on giant dice.



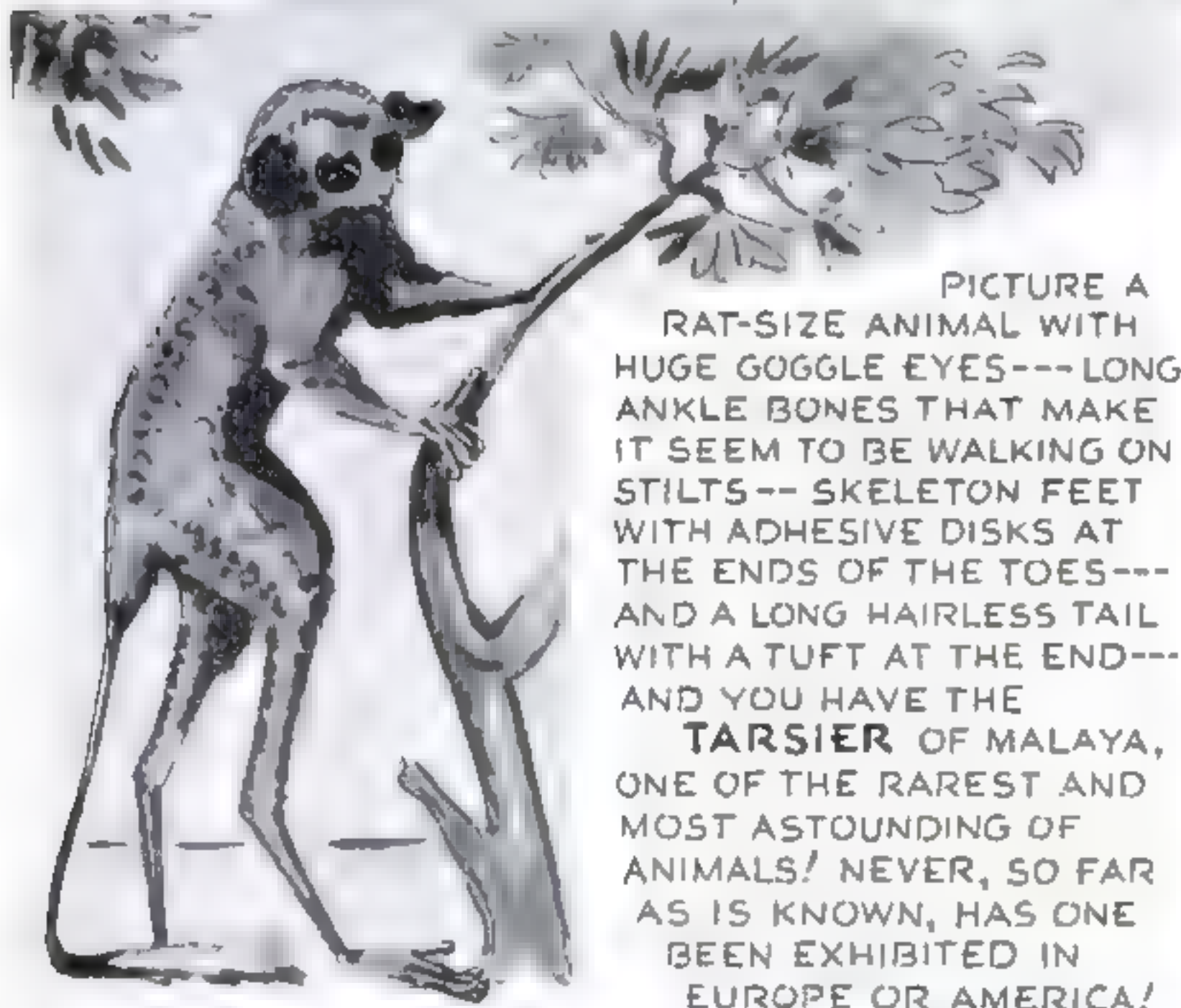
Eyeglasses Are Unbreakable

EYEGLASS lenses which can be struck with a hammer without breaking are now being manufactured in Los Angeles, Calif. Made of a synthetic resin that is said to be forty percent lighter than glass and twenty-five percent more transparent, the lenses are not ground but are pressed out with dies. The unbreakable "glasses" cost about the same as the ordinary kind now in general use.

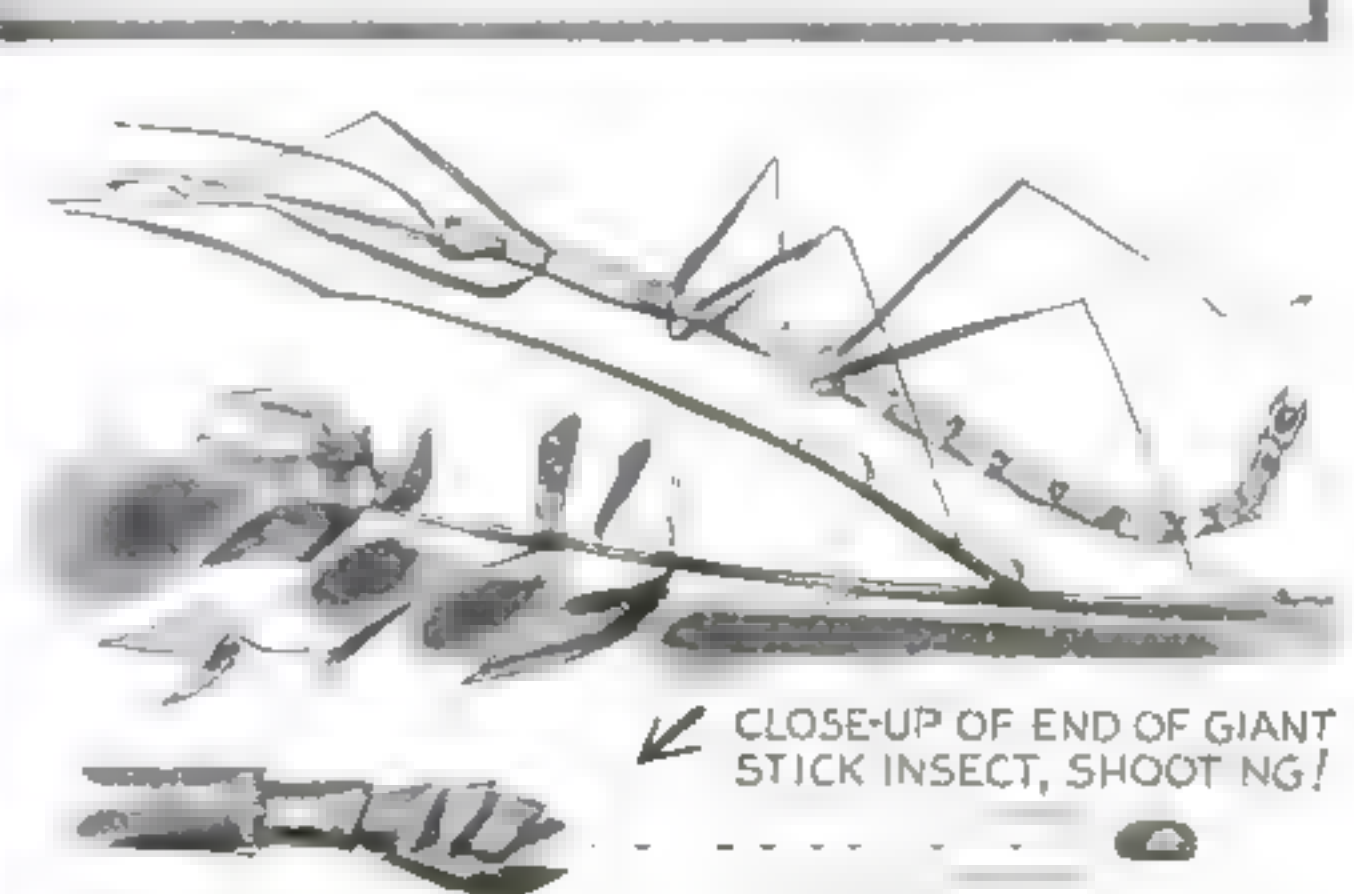
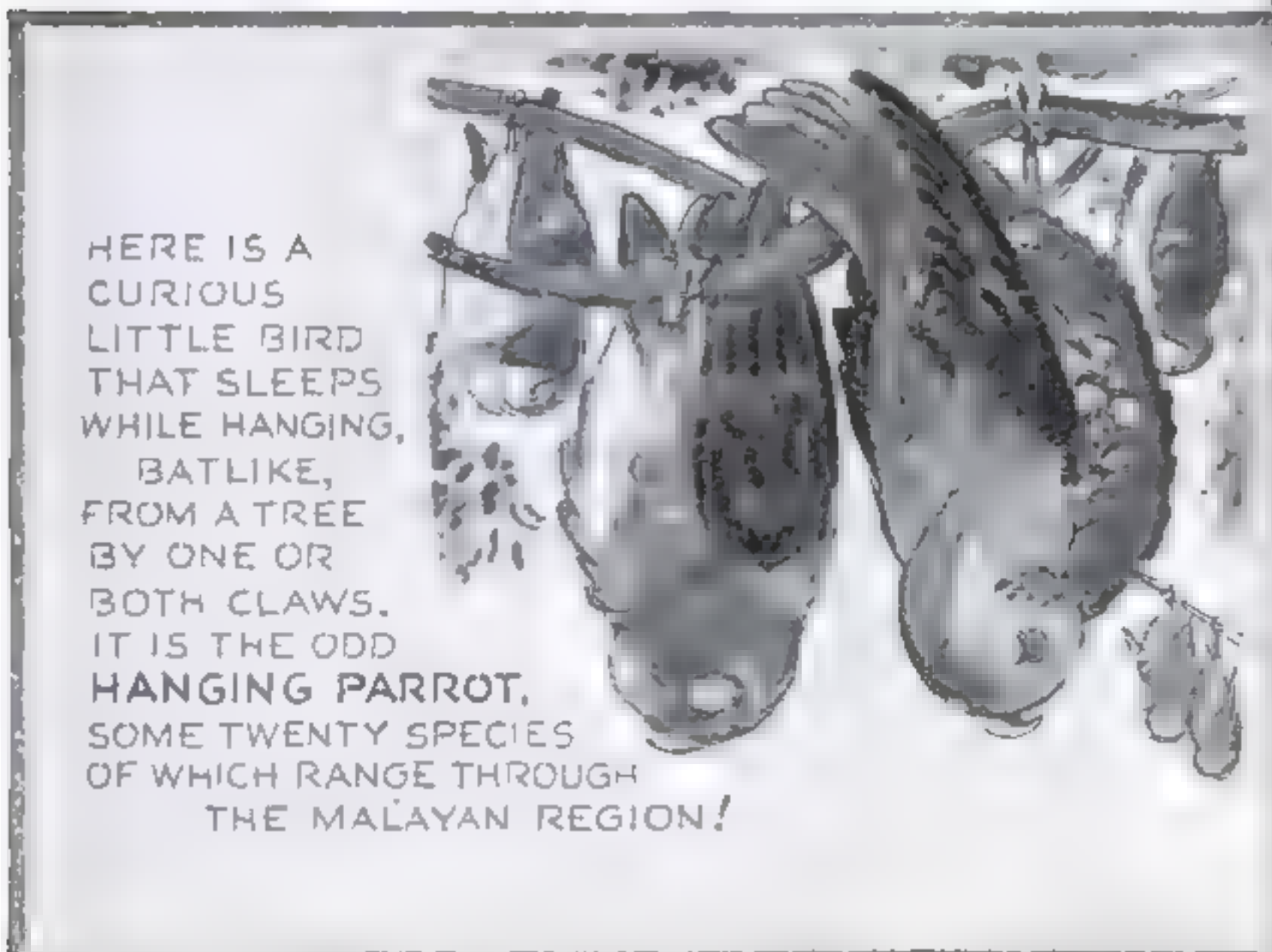
Un-Natural History By GUS MAGER



BATS' FACES SHOW MORE HIDEOUS VARIATIONS THAN DO THOSE OF ANY OTHER CREATURES! THERE ARE SPEAR-NOSED BATS, LONG-EARED BATS WITH EXTRA MEMBRANES IN THEIR EARS TO AMPLIFY SOUND, DOG-FACED BATS, NOSE-LEAVED BATS, AND MANY OTHER MONSTROSITIES!



NATURALISTS CANNOT EXPLAIN THE STARTLING DIFFERENCE BETWEEN THE EYES OF ZOO LIONS AND THOSE OF WILD LIONS! THE MENAGERIE ANIMAL'S DARK, SLEEPY-LOOKING BROWN EYES CONTRAST STRANGELY WITH THE BRILLIANT YELLOW ORBS OF JUNGLE BEASTS! CAPTIVE LIONS ALSO HAVE MUCH FINER MANES THAN THEIR WILD BROTHERS, BUT THAT IS ACCOUNTED FOR BY THE COLD, DAMP CLIMATE OF NORTHERN COUNTRIES!



SOME OF THE **GIANT STICK INSECTS** ARE THE BIG GUNS OF THE INSECT WORLD! THE FEMALE HAS A GUNLIKE APPARATUS AT THE REAR END OF HER BODY, WITH WHICH SHE SHOOTS HER EGGS FOR A LONG DISTANCE!

Crime-Detection Stunts



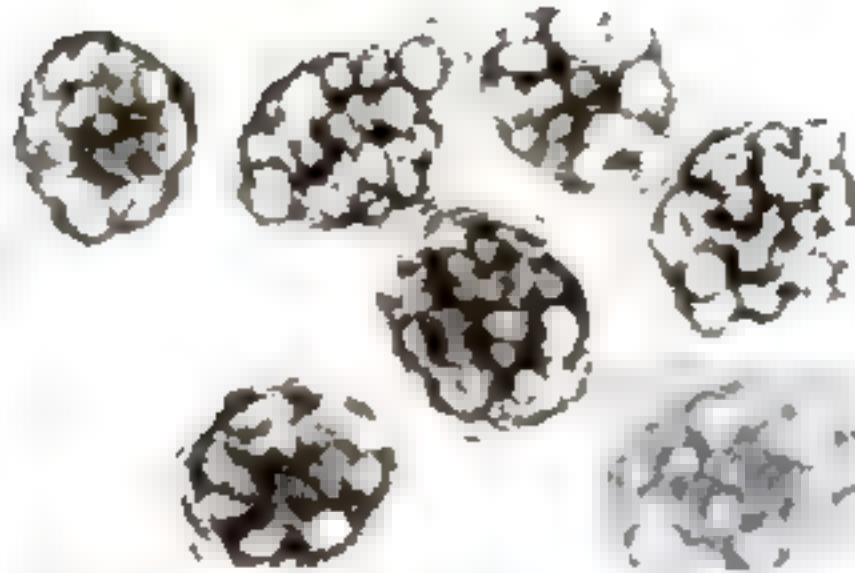
Applying the iodine color test for starch

THE body of Silas Mercer was found sprawled on the floor of his bakery, near a machine used for mixing bread dough. His clothing had been torn and pulled out of place, indicating a struggle. Sam Bolton, a former boss of the bakery machine shop, was suspected of the crime. He and Mercer had had a violent quarrel two days before, when Mercer fired him.

But Bolton had an air-tight alibi. His landlady testified that she had seen him enter his room on the evening preceding the crime, and that he hadn't left until the police came to take him to headquarters for questioning. Yet Bolton was confronted with such damning evidence that he finally confessed, and explained how he had slipped out the window, climbed down a rain spout to get to the bakery, and then climbed back in again after he had killed Mercer.

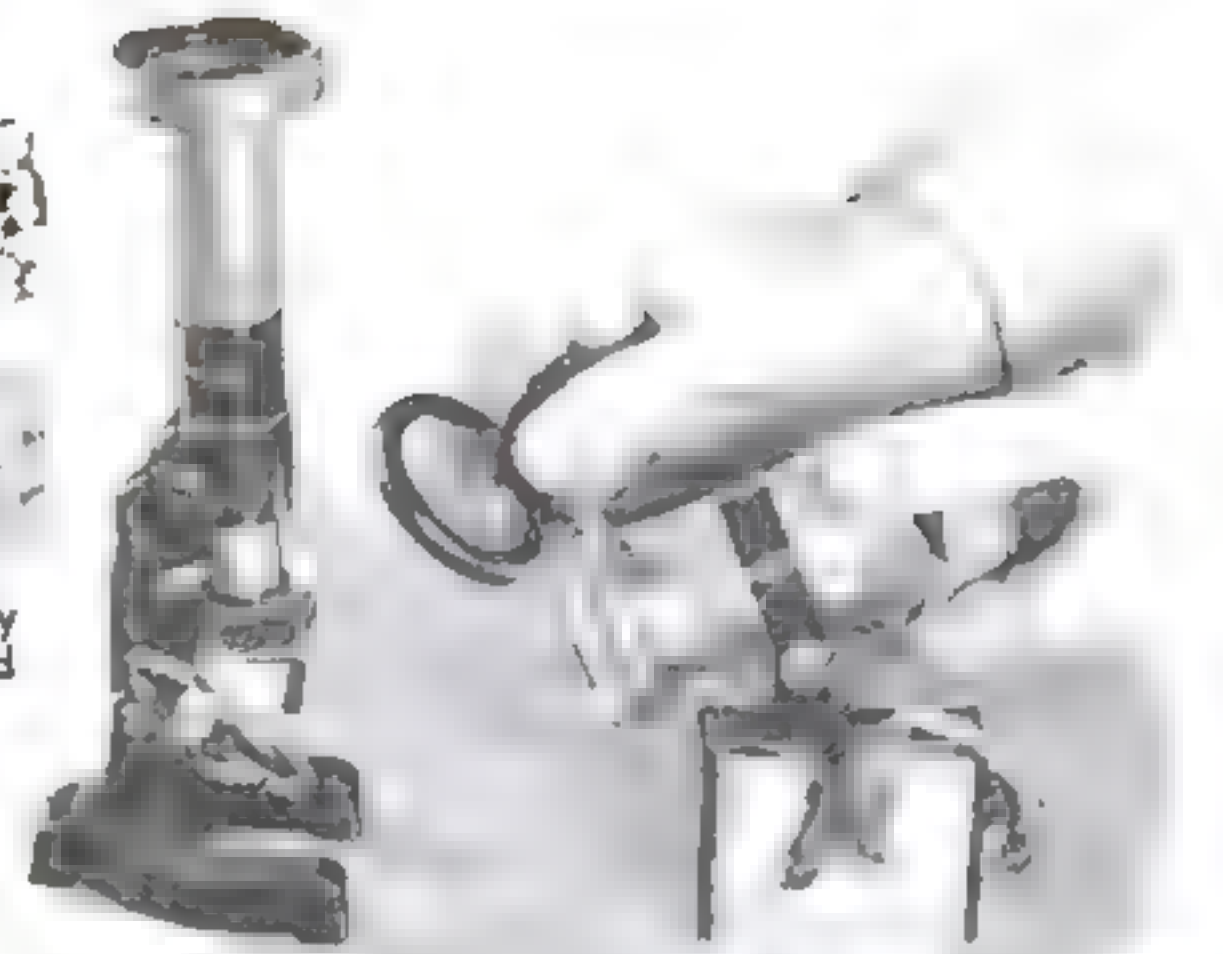
The things that convicted Bolton were a few innocent-looking grains of wheat starch—and a microscope. When the police found the body, and saw that there had been a struggle, they immediately reasoned that the killer must have picked up some flour on his clothing. Flour contains much starch, so the logical thing to look for was a collection of starch grains. They found them when they had Bolton at headquarters, on the legs of a pair of pants he had left in his room. The department microscopist had examined the dust from the pants in polarized light, and had seen the characteristic pattern of light produced by each grain; he also had applied the iodine test which produces a blue color in starch. To answer the objection that Bolton might have picked up the starch grains while he was employed in the bakery, the microscopist found similar starch grains on the surface of the spout the killer had used for a stairway.

This relatively simple case illustrates one of the numerous ways in which the microscope can be used in solving crimes and in unraveling other mys-



Starch cells from a bean, as seen by the microscope in the analysis of food

teries. The amateur microscopist may never be called upon to help "crack" a murder case with his magic lenses, but that need not stop him from having a lot of fun in becoming acquainted with some of the methods employed by present-day sleuths. Already you have seen how the amateur can make an inexpensive comparison microscope and use it for studying bullet markings, firing-pin impressions, typed characters, and other things that might be involved in criminal investiga-



Microscope and illuminator fitted with polarizing disks for examining substances by polarized light. Right, starch grains identified by crosses under this kind of illumination



Pith cells in a lilac stem that was stained blue with a common textile dye. Left, mixing dye

TEXTILE DYES as MICROSCOPE STAINS

ORDINARY household textile dyes, available at drug and department stores, often can be used effectively as stains for microscope specimens. Determining the ways in which you can use them will provide an interesting and inexpensive research problem. Bright blues, reds, and greens generally give the best results; try mixing them together in different ways to produce various kinds of stains. One interesting project is to concoct a dye that will color cotton fibers but not silk, thus

allowing you to test a "silk" cloth you suspect of being part cotton.

In most cases, the directions on the package will recommend that the dyes be used boiling hot, but this may be disastrous for delicate specimens such as thin sections of plant stem. However, dissolving the dyes in water will make solutions that are effective for many staining operations. Leave the specimen in the dye mixture until it has absorbed a deep color, and then rinse in water before drying and mounting in balsam. Many of the dyes also can be dissolved in alcohol or dioxan.

with Your Microscope

With your own magic lenses,
you can duplicate many of
the tests that are employed
to solve baffling mysteries

By
MORTON C. WALLING

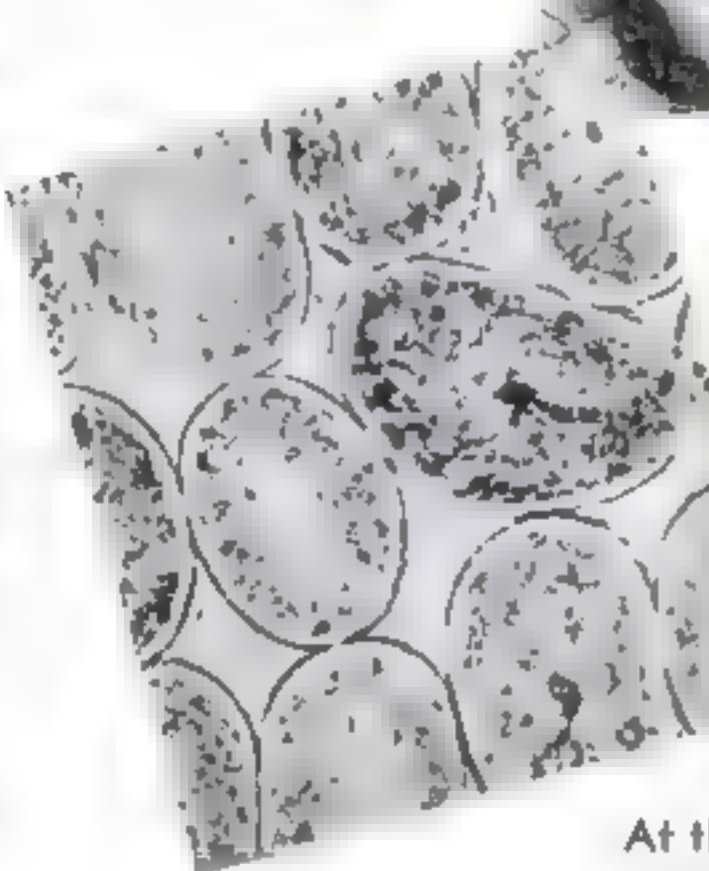
tion (P.S.M., April '37, p. 68). While an ordinary microscope is unsuitable for such work as this, its owner still can delve extensively into microscopic sleuthing.

Among the easy investigations that he can pursue with his instrument are the identification of blood by examination of cells, inspection of blood crystals, study of vegetable tissues and fibers such as might be involved in the analysis of stomach contents, identification of hairs, examination of industrial dusts and metal chips, and study of paper and textile fibers.

The starch episode already described is an example of how an industrial dust might be involved in the solving of a mystery. When a crime is committed where such dust exists, and particles of the same dust are found on the bodies or possessions of persons who could not have picked it up unless they had been at the scene of the crime, the evidence is extremely strong. The microscope plays its part by magnifying the dust particles so that they can be identified by their form or by their reaction to various tests. Starch, a common dust, turns blue when treated with a weak solution of tincture of iodine. Even a half dozen grains under the microscope are more than enough to make the iodine test positive. Further checking can be done by examining the starch grains by polarized light, under which each will appear marked by a characteristic cross.

A yegg drilling a hole in a safe cannot help collecting some of the minute

A professional comparison microscope in use. The photograph above shows how it compares a typewritten character with the same letter as made on a known machine, by joining parts of both in a split image



At the upper left are cross sections of human hairs. At upper right, a blond human hair, highly magnified. Right, mounting a hair in a special medium for testing

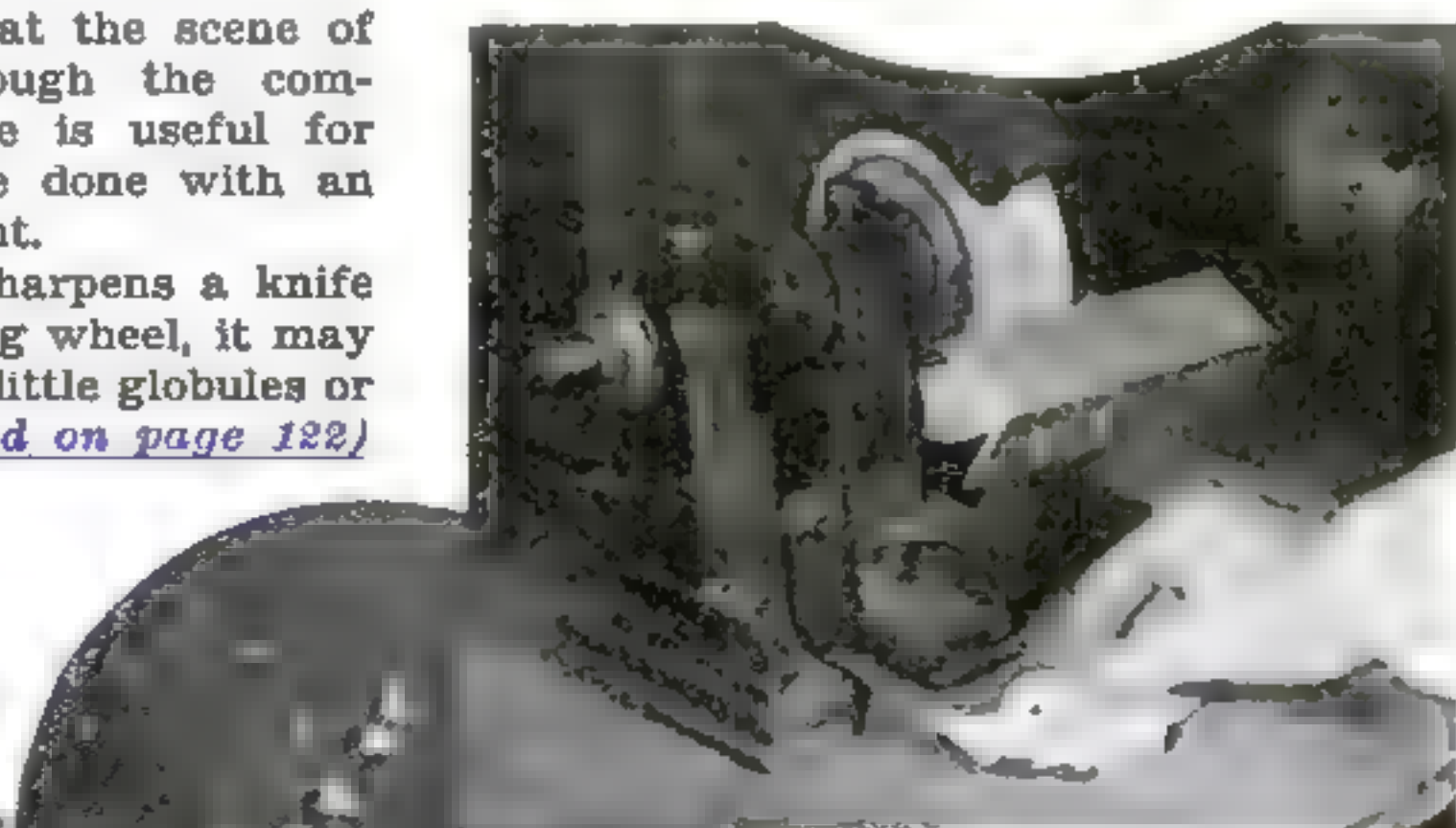
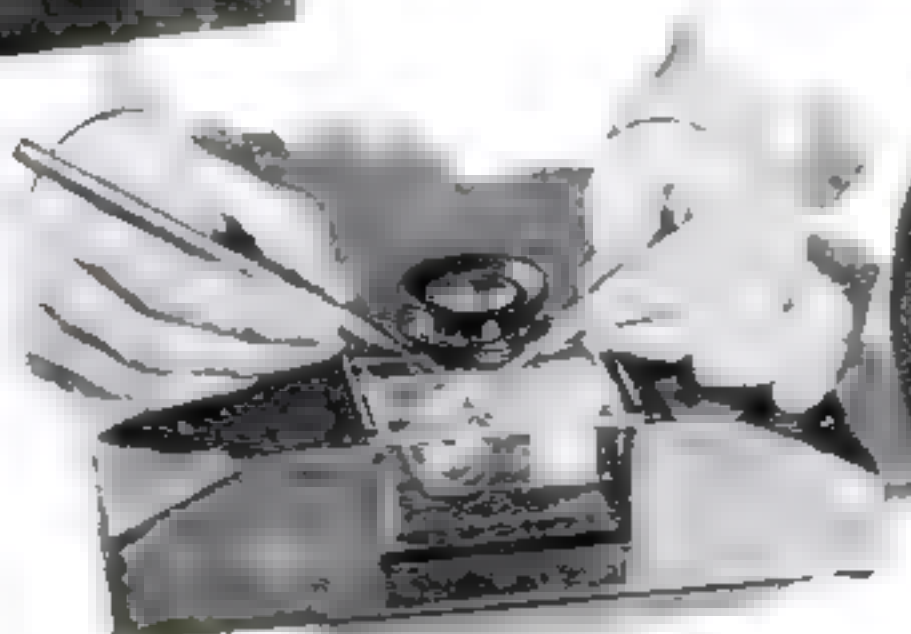


particles of steel on his clothing. Police can go over a suspect's clothing with an electromagnet and gather fragments for comparison with other steel chips found at the scene of the crime. Although the comparison microscope is useful for this, much can be done with an ordinary instrument.

If a murderer sharpens a knife or ax on a grinding wheel, it may be possible to link little globules or chips of *(Continued on page 122)*



A specimen of food under the microscope. Note the springlike duct walls, typical of certain vegetable tissues. At the right, a bit of food is being pulled apart preparatory to examining it for characteristic fibers and other features



Steel particles from a grinding wheel, picked up as above, may give valuable clues. The globules seen magnified at the left were formed by the cooling of glowing sparks of molten metal

HANDY AIDS



TWO-LAYER MATTRESS. Spring and padding are entirely separate in the mattress illustrated above. The light-weight pad can be turned easily to fluff it up. One side of the spring section is heat-insulated, making special adjustment possible for hot or cold weather

MUSICAL LAMP. The happy smile of the baby in the picture below is produced by the tinkling notes of a music box concealed in the stand of the lamp that sits beside his crib in the nursery



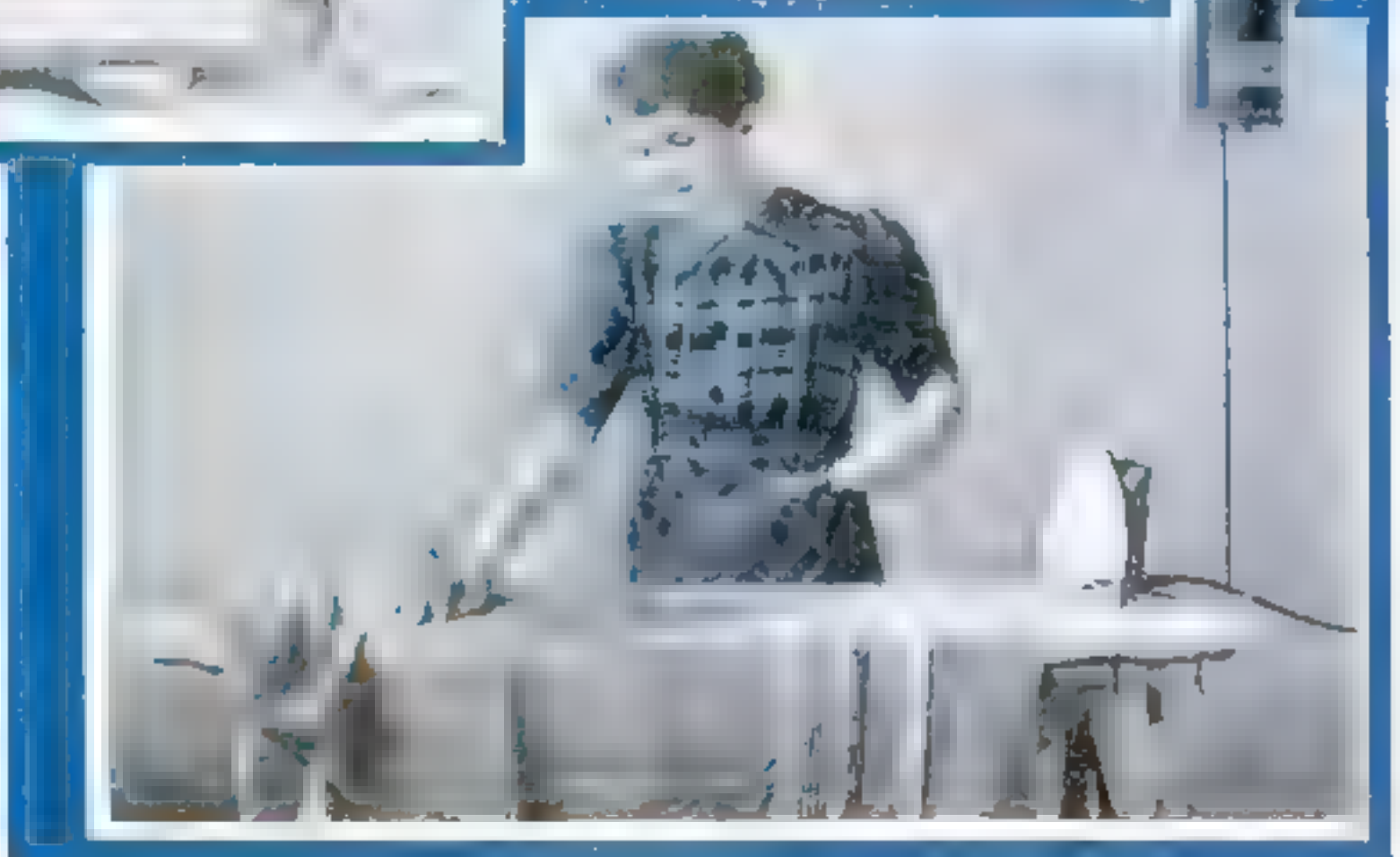
WIRE-BOTTOM PIE PAN. Designed to give a complete circulation of quick, dry heat, the pie pan shown below has a closely woven wire bottom set into its metal frame. The novel utensil is said to insure even baking and to turn out pies that have crisp, brown bottom crusts



FOLDING FAN. Fitted with an eight-inch propeller-type blade, the folding electric fan below can be hung or stood anywhere. When suspended in an open window, as at the left, it serves to remove cooking odors from the kitchen



CLOTHES DAMPENERS. Screwed on a standard fruit jar containing water, the device at the left is run across clothes. The sprinkler below has an elevated container



FOR
THE

HOUSEHOLD



HANDY DRIER. A versatile new clothes drier can be clamped onto an open oven door, the top of a table, or the back of a chair. It also will stand upright, or hang on a wall as indicated by the circle in the picture

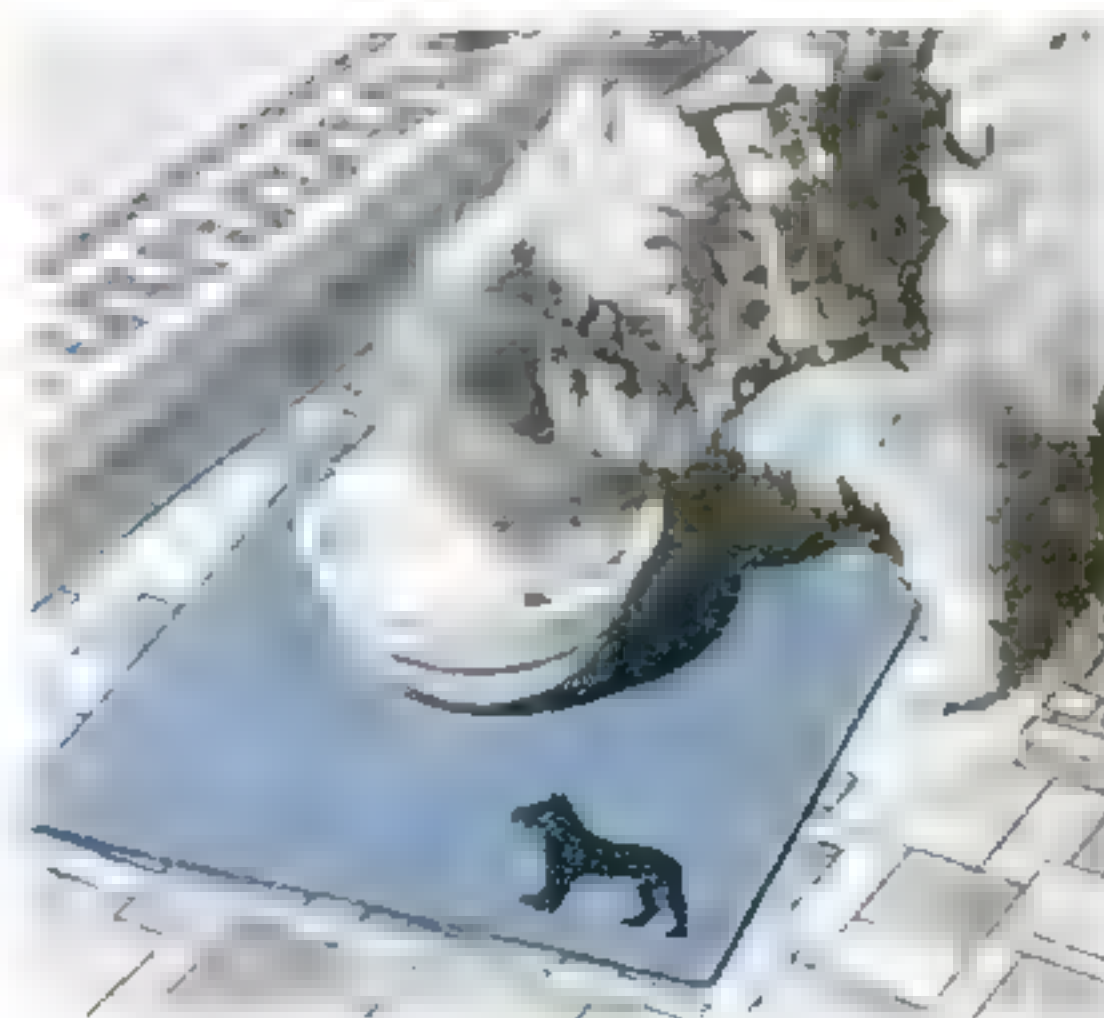
INSET ROASTER. A novel feature of a new electric range is a ten-quart porcelain-enameled roaster set into the top. It is said to be suitable for all roasting and baking operations, and also for stewing



IMPROVED CABINETS
These illustrations show a few of the new ideas in kitchen cabinets. At the right, vertical racks for pans and trays save space and work. Below is a ventilated drying compartment for towels. The picture at the lower right shows a special receptacle for beverage bottles



DOG-FEEDING MATS like the one pictured below enable pets to enjoy their meals on the kitchen floor without soiling the linoleum. Made of cork, the mats present a rough surface to keep dishes from being pushed about



Put Your Garden

...EASY EXPERIMENTS



Collect bits of soil from various parts of your garden and mix them

By **RAYMOND B. WAILES**

HOW is your garden growing? If the plants appear sickly or underdeveloped, a horticulturist would look first for injurious insects. Then he would examine the soil to see whether it is the type that the plants need.

Perhaps the earth should be a little more acid, or alkaline. Possibly it needs more of certain plant foods such as phosphorus or nitrogen—for all kinds of house and garden plants, as well as shrubs, trees, and farm crops, have their own favorite kinds of soil. Plants die and crops fail, all too often, because the grower does not know their soil needs, or because no means of testing the soil is at hand.

However, any amateur chemist can readily test the soil of his own garden. Only the simplest of chemical equipment is required. Just one special precaution need be taken. Test tubes, testing plates, measuring devices, and even the experimenter's hands must be scrupulously clean—in the chemical, as well as the ordinary, sense of the word. Every trace of scouring powder or soap used in washing up your home-laboratory ware, for example, must be carefully rinsed away; otherwise the natural alkalinity of these substances would ruin the delicate test that determines whether soil is acid or alkaline.

You might imagine that a simple way to test the acidity or alkalinity of the earth from your garden would be to break a moist lump of it in two, press strips of blue and red litmus paper between the halves, and observe the final color of the test strips.

This will not work, however, as litmus is not nearly sensitive enough for soil testing.

The "indicator" or testing material that will serve your purpose is a solution, in water, of a dye commonly spoken of as "brom thymol blue." If you like tongue-twisters, you can call it by its full chemical name, "dibromothymolsulphonphthalein." You can obtain the small quantity of the dye that you will need, in dry form, from any well-stocked dealer in chemicals or microscope supplies. Take a tenth of a gram of the test chemical and dissolve it in about 200 cubic centimeters (nearly a drinking glass full) of water, meanwhile heating the water gently—say, to sixty degrees centigrade (140 degrees Fahrenheit). Then dilute the solution with more water to a total volume of about 330 cubic centimeters. Tap water may



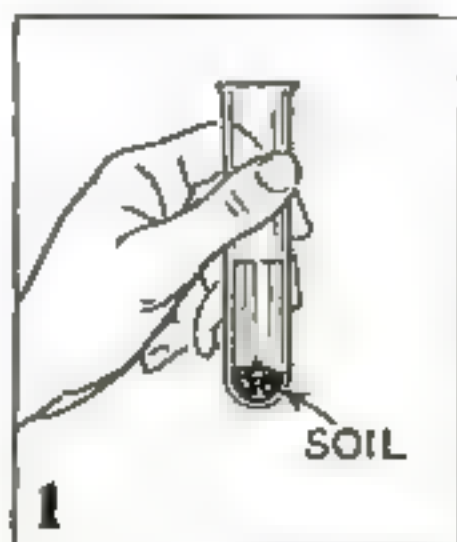
To prove that soil readily absorbs potassium, let a solution of potassium chloride or potassium carbonate seep through soil in this apparatus. The liquid that comes out contains hardly any of the potassium



Traps for insects are made by spreading a poisonous mixture in jar lids and bottle caps



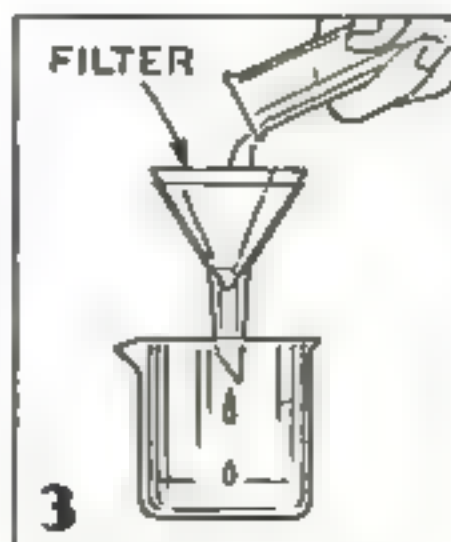
THIS SIMPLE TEST READILY REVEALS THE PRESENCE OF PHOSPHORUS



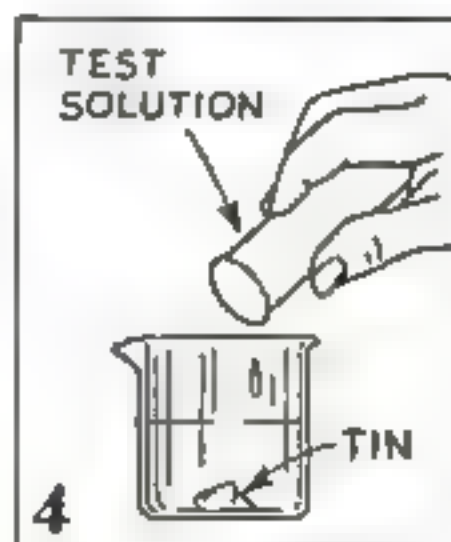
Place a half-teaspoonful of the earth in a test tube and add a small amount of water



Now add one drop of "one-to-three" acetic acid (one part glacial to three parts water)



After shaking the contents of the test tube for half a minute filter into a beaker



Put a piece of sheet or lump tin in a little of the filtrate and add test solution



If a blue color appears in the liquid, the soil contains the desirable phosphorus

in the Test Tube

SHOW CHARACTER OF SOIL

be used if necessary; to insure accuracy, however, it is always preferable to use distilled water in making up reagents, or test solutions.

Brom-thymol-blue solution responds to an alkali, even in small amounts, by turning blue. When the dye solution is made neutral—neither acid nor alkaline—it takes on a dark-green hue. In the presence of an acid, it turns yellow or orange, according to the degree of acidity.

For soil testing, the solution should be neutral or dark-green. Therefore, the yellow solution you obtain from the solid dye must be neutralized with clear, filtered limewater (calcium hydroxide solution). A few drops should be sufficient. Don't attempt to judge the color of the brom-thymol-blue solution by looking at a bottleful or beakerful; pour a sample of it into a test tube, and hold the tube between your eyes and the light. If you have added too much limewater, the liquid will be blue. A drop or so of extremely dilute acid (taken from a solution, say, of one drop of strong sulphuric acid in 300 cubic centimeters of water) may then be added to the entire batch of dye solution to bring back the correct color. If you use too much acid and the solution becomes yellow, add limewater again, and so on, until you finally obtain the dark-green color that you want.

Keep the test solution, if possible, in a bottle made of the kind of glass used in transparent oven ware. Ordinary glass is slightly alkaline and may turn it blue; however, its color may always be corrected immediately before use, as just described.

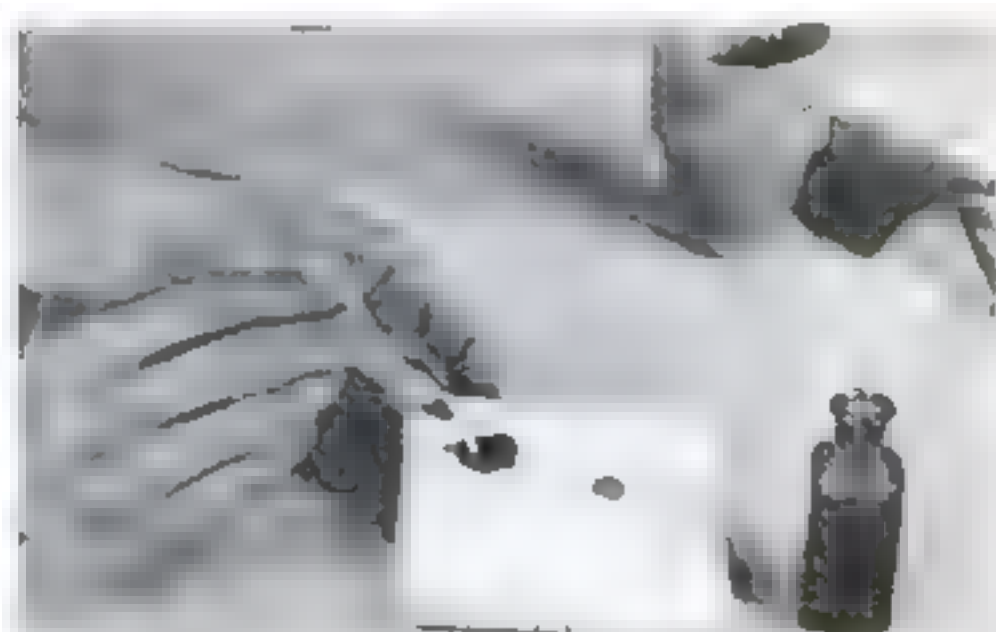
To test the soil in any garden or field with your solution, collect bits of earth here and there and mix them thoroughly to obtain a representative sample. Then place a pinch of the soil upon a glazed white porcelain plate, a bathroom tile, or an artist's slab. Add enough of the neutral test solution to the soil to make it watery. Also place a few drops of the solution elsewhere on the plate, for comparison and to make sure it has the proper dark-green color. After half a minute, carefully tilt the plate, allowing the liquid to



The dye solution used in testing soil for acidity or alkalinity should be made neutral by adding limewater or a weak acid solution, as needed, until it takes on the characteristic dark-green hue



Fractions of a gram of a chemical can be measured by dividing a larger, spread-out amount



TESTING THE SOIL FOR ACIDITY

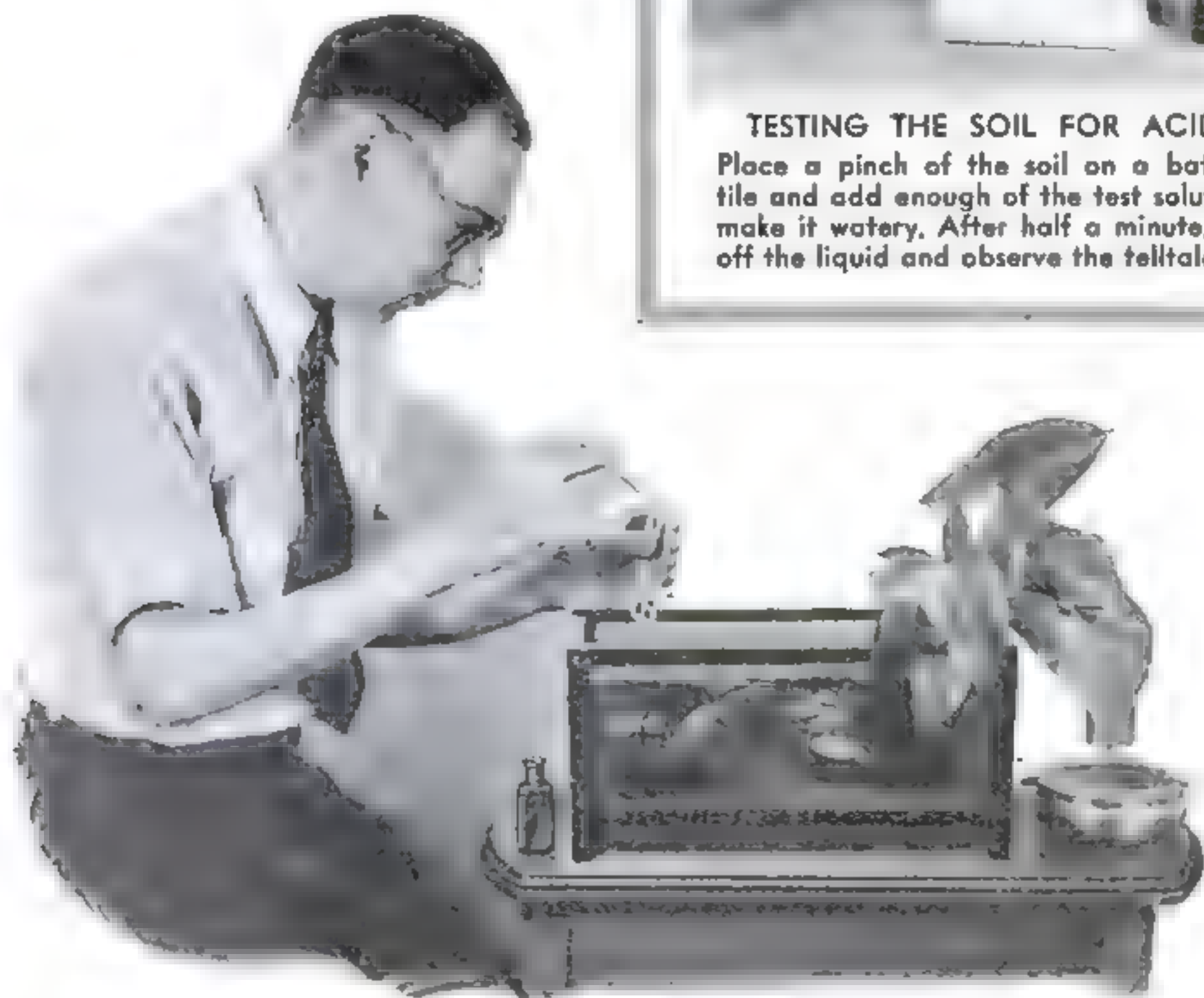
Place a pinch of the soil on a bathroom tile and add enough of the test solution to make it watery. After half a minute, drain off the liquid and observe the telltale color

drain from the soil and flow across it. If this solution is now yellow or orange, the soil is acid. If the drained liquid is blue, the soil is alkaline.

Gardening books will supply the rest of the information you need—the soil requirements of various plants. Azaleas, rhododendrons, mountain laurel, and broadleaf evergreens, for example, prefer an acid soil. If they are planted in a soil that is alkaline—say, one containing limestone, building plaster, or lime—they will surely die. The soil may be replaced with earth from the woods, or may be treated with applications of ammonium sulphate, aluminum sulphate, tan-

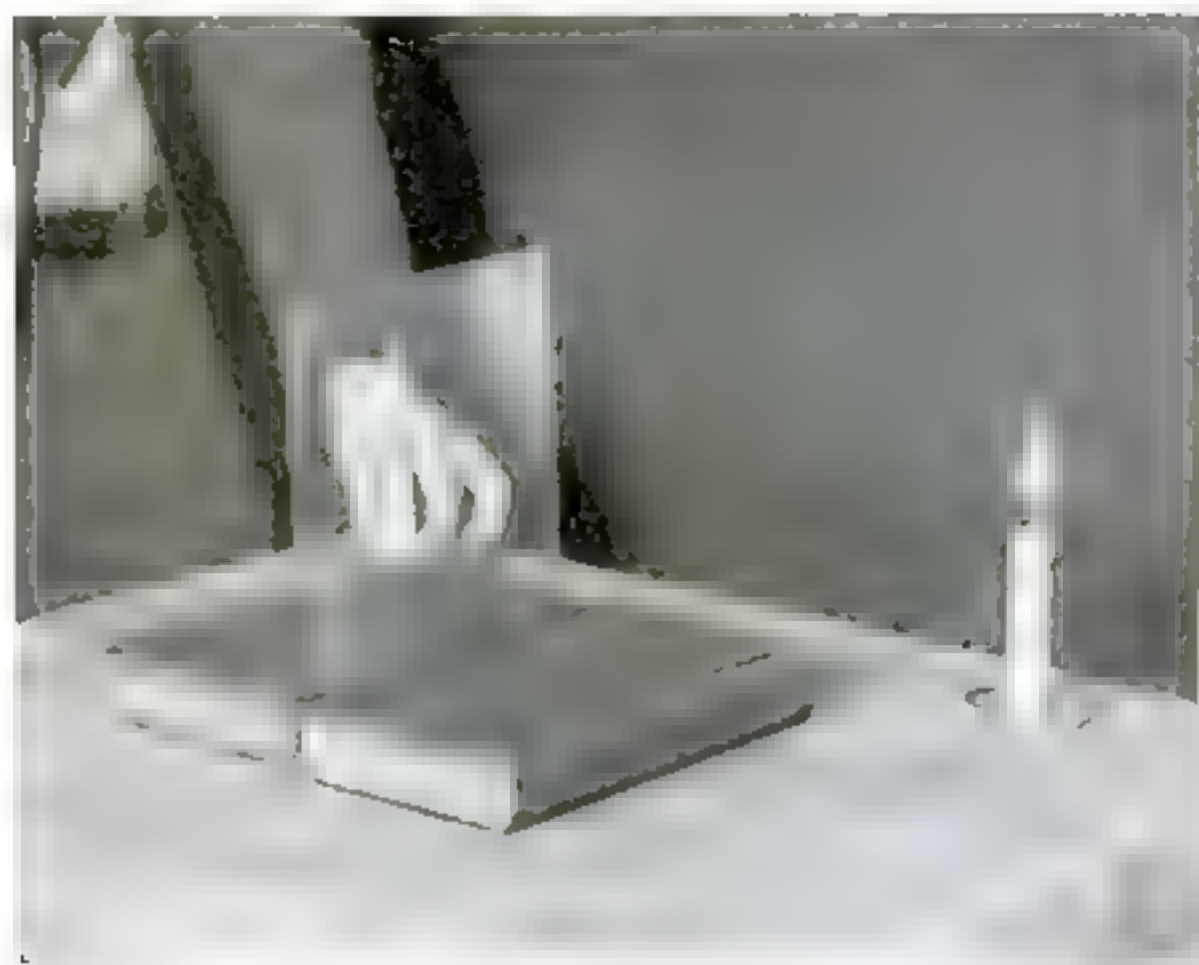
nic acid, or flowers of sulphur, to put the plants in their proper environment.

Your brom-thymol-blue solution will also come in handy for testing the water of your outdoor lily pool and your indoor aquarium. This water should be faintly acid, if your fish are to thrive. To a ten-cubic-centimeter sample of pool or aquarium water, add half a cubic centimeter of the dark-green soil-testing solution. If the liquid turns blue, then it is alkaline, and the contents of the entire aquarium should be acidified with a drop or two of very dilute muriatic or sulphuric acid. Repeat your test after you have done this. If the sample now turns yellow or orange, it is definitely acid—in fact, too much so. Aquarium water of the correct acidity should give an in-between, greenish-yellow color with your test solution. If the dark-green color of the reagent undergoes no change whatever, the water is neutral; it will sup- (Continued on page 124)



The solution used for testing the acidity of your soil also will tell you whether the water in your indoor aquarium is acid or alkaline. It should be faintly acid

NOVEL TESTS OF Scientific Laws

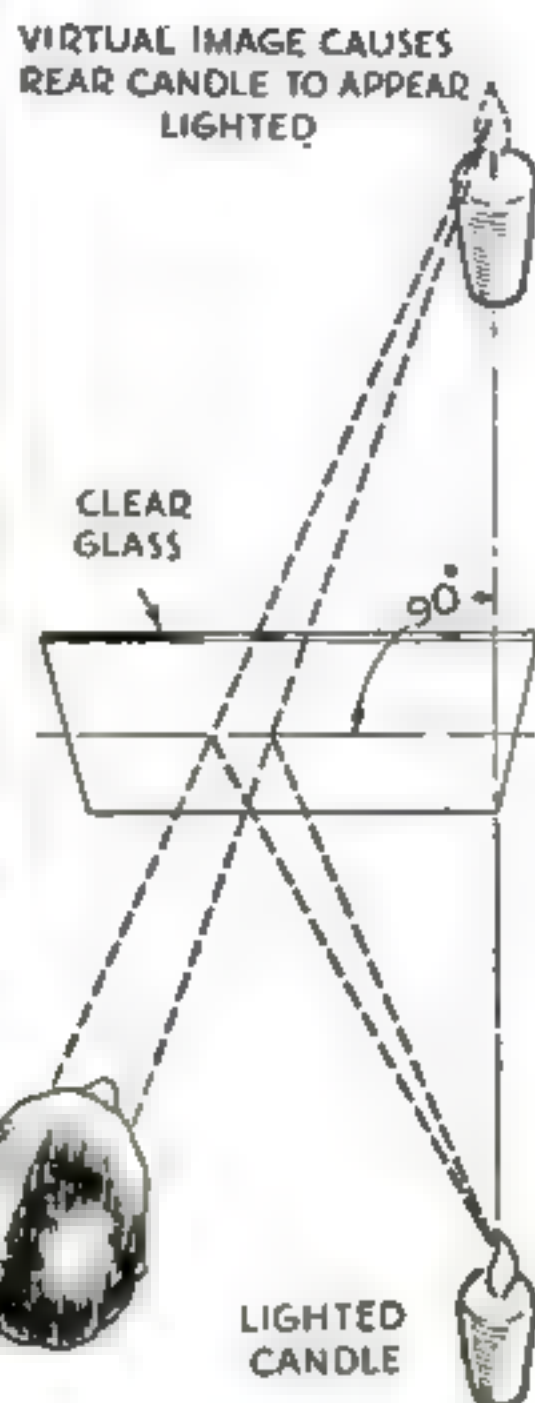


Apparent Position of a Reflected Image

BY MEANS of the stunt illustrated above, you can locate the apparent position of a reflected image and demonstrate a law of optics. Place a lighted candle in front of a sheet of glass and have a friend move an unlighted candle behind the glass until it coincides with the reflected image. The unlighted candle then will appear lighted and will be just as far behind the glass as the flame is in front.

Burning Matches Prove Matter Indestructible

SUSPEND several matches from a wire in a tightly corked flask, their heads touching the glass, and hang the flask on an improvised balance as shown below, with the beam held level by a weight at the other end. Ignite the matches by gently heating the glass. The balance remains level, showing that the gases and ashes produced weigh the same as the original matches.



You're Wrong! An Electric Fan Doesn't Cool the Air

WHEN you sit in the refreshing breeze of an electric fan, do you think that the fan cools the air? Hold an ordinary thermometer in the breeze, and you will find that the temperature is not lowered. But if you put a piece of wet cotton around the bulb, the temperature will drop quickly and stay down until the water has evaporated. Cooling by fans depends on evaporation of skin moisture.

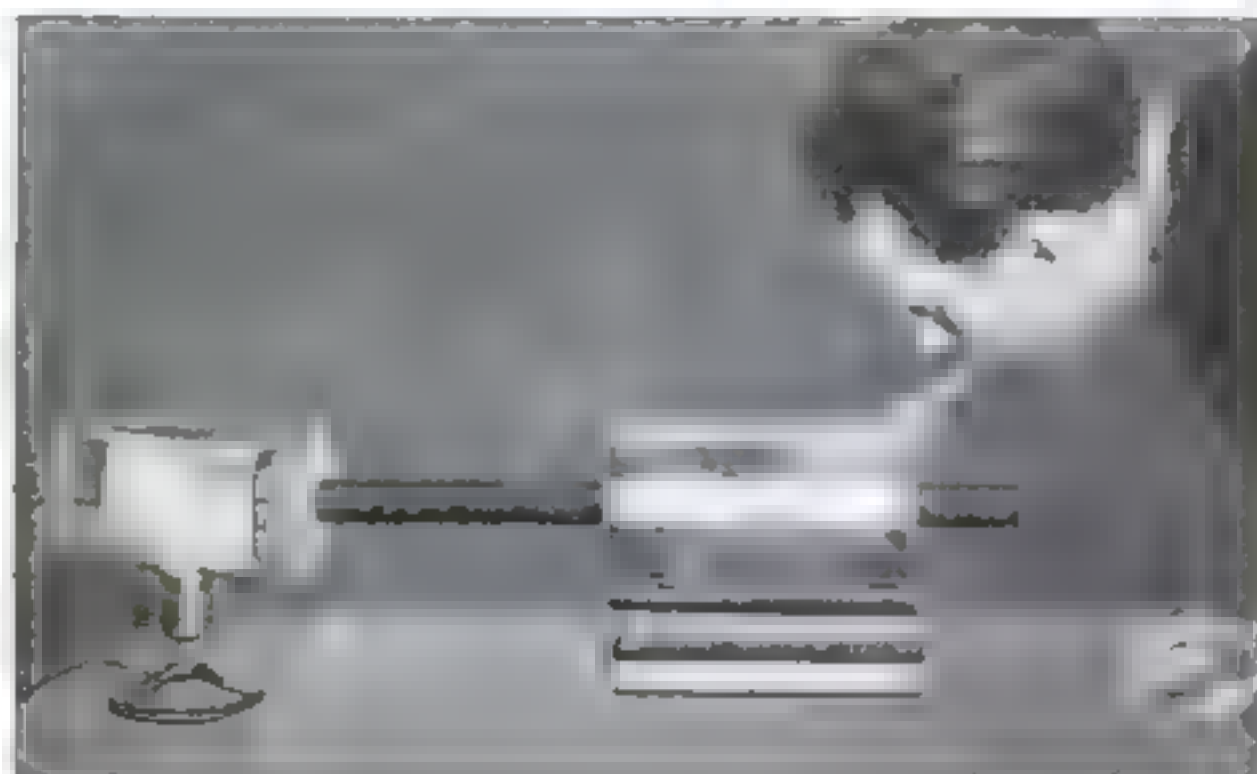
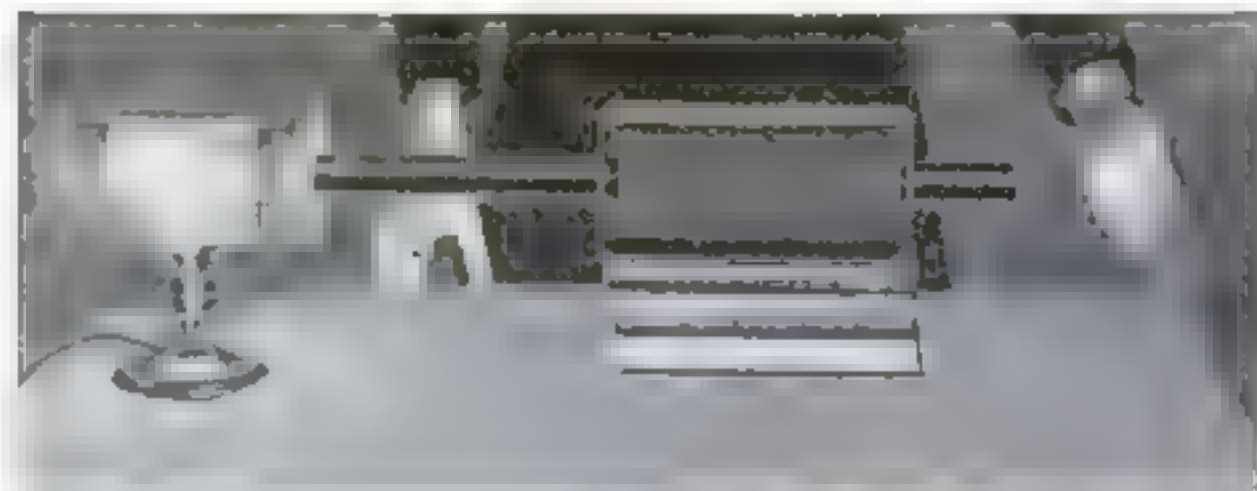
Simple Apparatus Demonstrates That Soil Contains Life

POUR limewater (slaked lime dissolved in water) into two glass jugs, and in one of them hang a cloth bag containing a little fresh soil. Connect the bottles with a glass tube, as at left, with some colored water in the middle as an indicator. After a few days, the liquid in the bottle containing the soil will have turned milky-white and the indicator will have moved toward that bottle, because soil bacteria produce carbon dioxide and use up oxygen.



Test Shows That Rays of Light are Invisible

A RAY of light is invisible except when you look directly toward the source. To prove it, blacken the inside of a cardboard box and, in a darkened room, arrange tubes and a lamp to direct light through it as shown at the right. If the air is free of dust, you will see nothing in the box. To show that light is passing through, puff smoke or dust into the box and the beam will immediately shine out. What you see, however, is not the original beam, but the reflection and refraction of it by particles of matter floating in the air.



New Ideas for Radio Fans

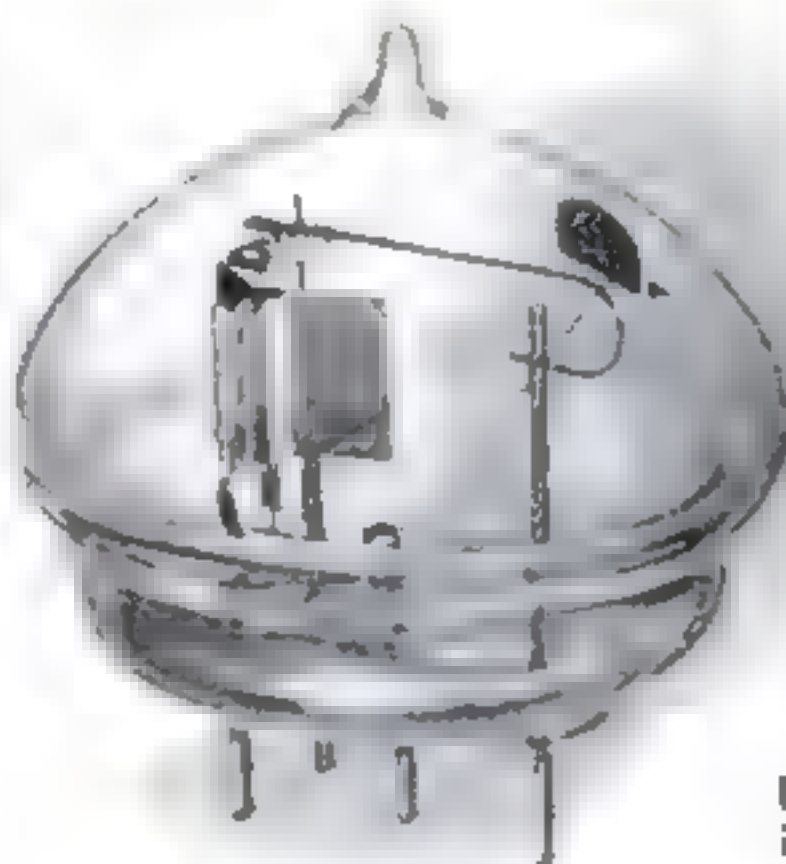


Novel Way to Coil Solder Makes Handling Easier

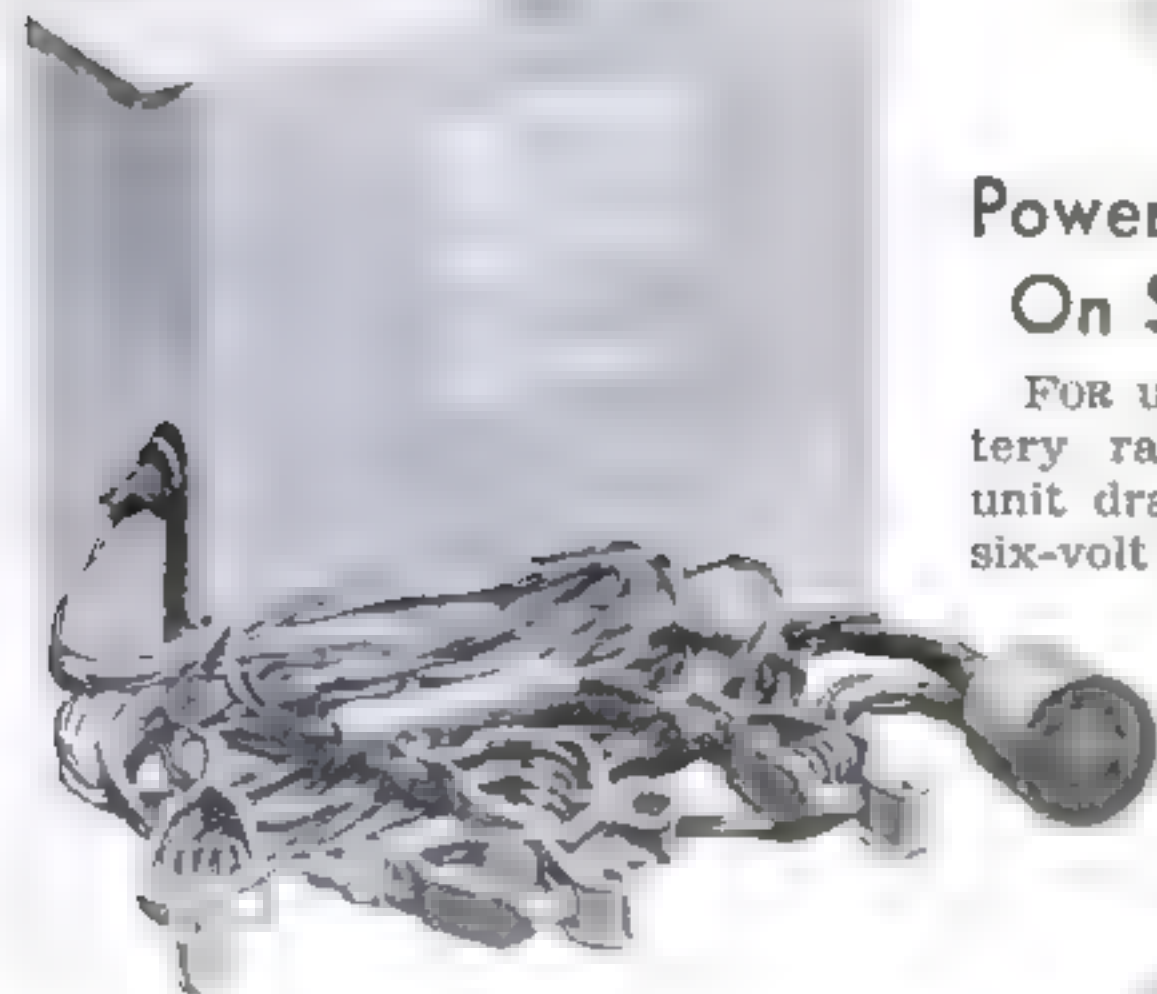
WHEN making soldered connections, the nuisance of a dangling coil of wire solder can be eliminated by wrapping the solder around a half-inch dowel or other rod of similar diameter. Slip the wire off the form, and push the free end through the coils, as shown. The material thus forms its own handle, and as the end melts off, more solder can be pulled out.—E. H.

New Tube Increases Power of Ultra-Short Wave Sets

DESIGNED for use on the ultra-short wave lengths below ten meters, a new transmitting tube of the acorn type provides a remarkably high power output for its size. Measuring only two and a half inches in diameter, the midget unit is expected to increase greatly the range of transmitters constructed for use on the extremely high frequencies, as well as for experiments in television.



Left, this new acorn-type tube is two and a half inches in diameter. Above it is shown in use on a transmitter



New "B" Battery Is Smaller Than Flash-Light Cell

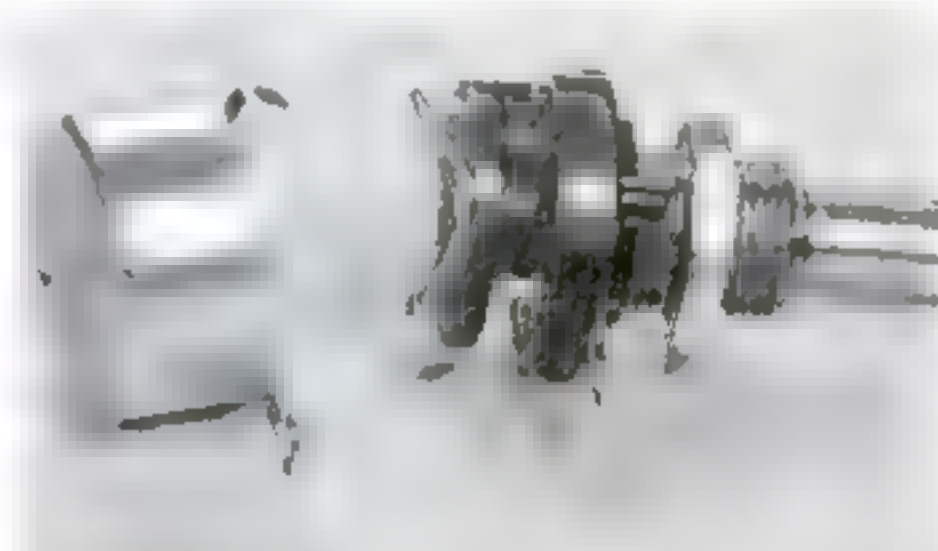
WEIGHING less than two ounces, a new forty-five-volt "B" battery that is actually smaller than a common flash-light cell has been introduced for application in portable circuits where weight and size are important. Despite its size, the unit is long-lived.

An ordinary dry cell dwarfs the midget "B" battery



Power Unit Runs Two-Volt Sets On Six-Volt Battery Current

FOR use with the popular two-volt battery radios, a newly introduced power unit draws its current from an ordinary six-volt storage battery. The device is said to provide economical operation on farms and in other places where house current is not available



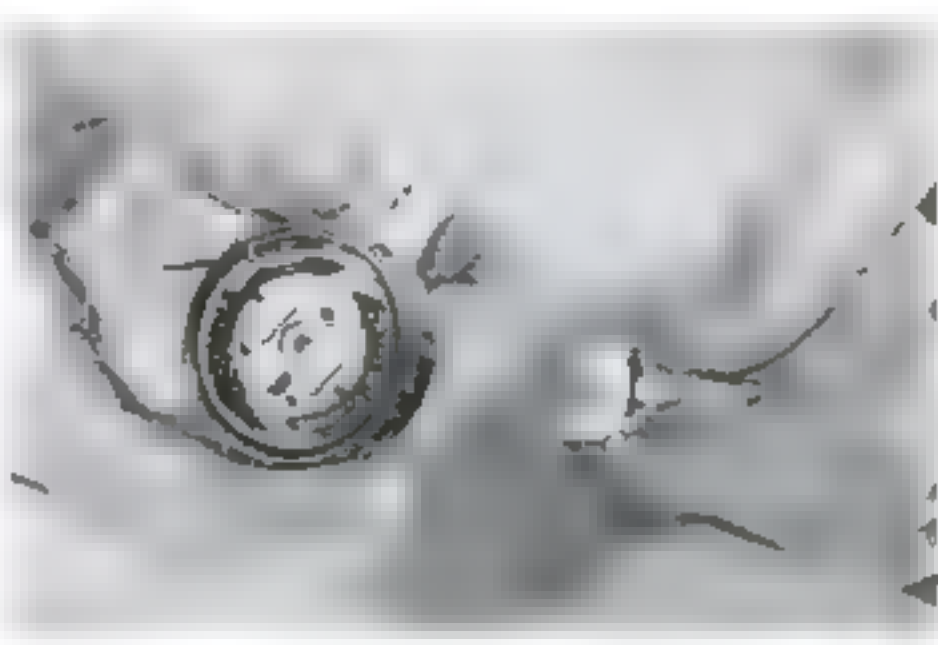
Volume control opened to show resistance

Dime-Size Volume Control Takes Up Little Room

FOR compact receivers, where space is at a premium, a tiny volume control, no bigger than a dime, will appeal to amateur radio constructors. Working on the conventional carbon-resistance principle, the new, eleven sixteenths-inch diameter rheostat is available in a number of ratings, and can be used for either a volume regulator or as a tone control.

Miniature Dynamic Speaker Fits in Palm of Hand

ONLY three inches in diameter, a novel loudspeaker unit now available to amateurs takes up a minimum of space in portables and other compact receivers. The speaker is available in either dynamic or magnetic form, and also can be used as a microphone.

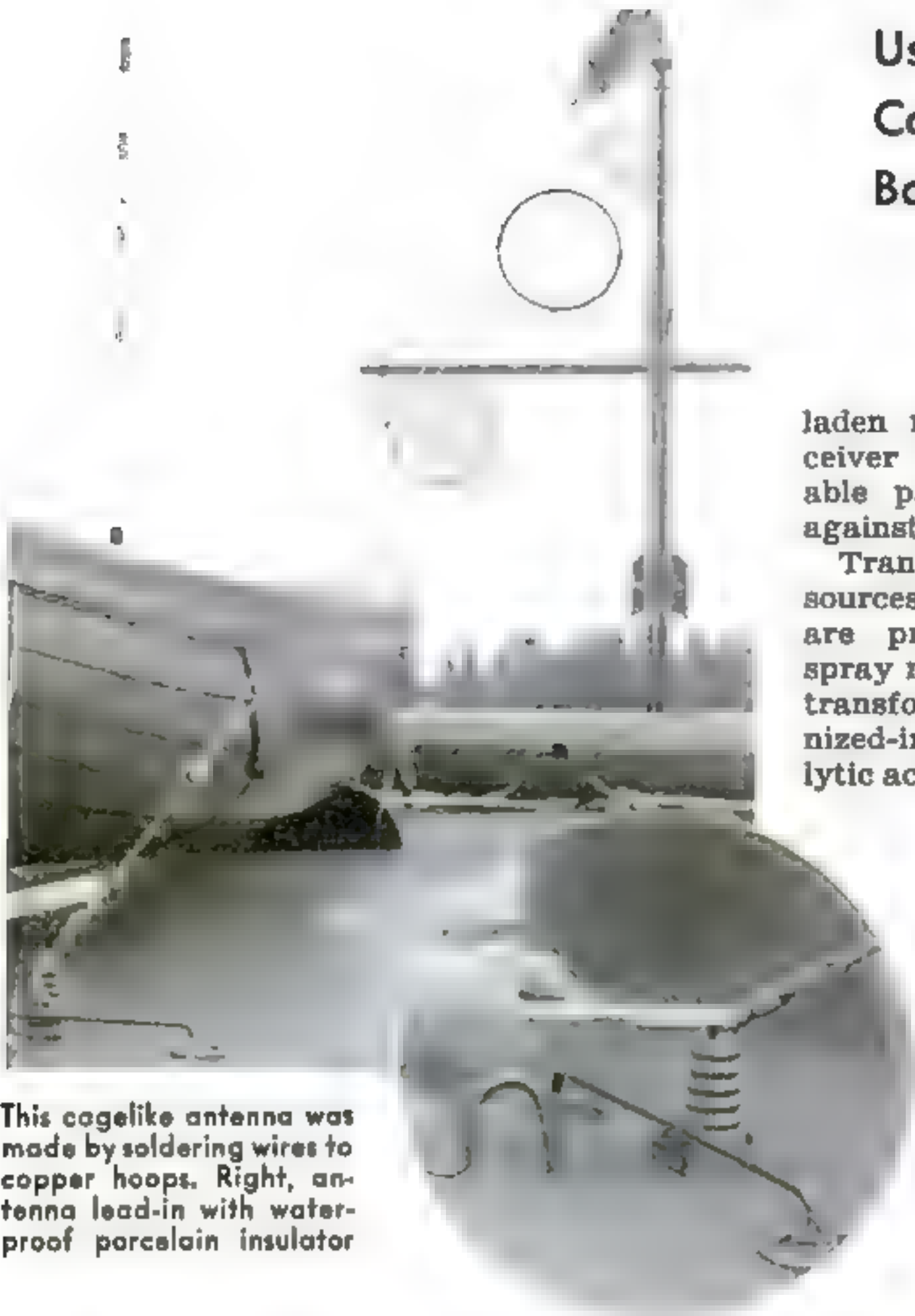


The new rheostat beside one of normal size

When Your Radio

Using a Receiver on a Sailboat or Motor Boat Calls for Special Preparation and Installation, Both of Which Are Described in This Article

By WALTER E. BURTON



This cogelike antenna was made by soldering wires to copper hoops. Right, antenna lead-in with waterproof porcelain insulator

IF YOU plan to use a radio receiver on your sailboat or motor boat this summer, there are certain precautions that must be observed if it is to give unfailing reception. Incorrectly installed or not specially prepared for its life on the briny, it will develop all sorts of troubles, and may even cause serious damage to the boat.

First of all, a marine radio receiver should be sturdily built and highly sensitive if it is to give all-around satisfaction. The high sensitivity is desirable because, on most boats, it is not possible to use an antenna long enough to permit a receiver of low or moderate sensitivity to perform well.

To protect the various condensers and resistors from excessive moisture, the receiver should not be placed too close to the upper deck nor too near the bilge. If near the deck, it is likely to be subjected to extreme heating at times, and cooling at others, which results in the condensation of moisture on the cabinet, coils, and other parts. If too near the bilge, similar condensation may occur. The best position is near the center of the boat, preferably on a bulkhead about at its midpoint. Wood cabinets, it has been found, give less trouble from condensation than those made of metal.

Perhaps the biggest bugaboo of any seagoing radio installation is electrolysis—the creation of a destructive electric current by the action of salt water on metals. It is difficult to keep salt-

laden moisture out of the receiver cabinet, so the vulnerable parts must be protected against it.

Transformers are frequent sources of trouble unless they are properly protected. Salt spray may set up electrolysis in transformers that have galvanized-iron frames, the electrolytic action taking place between the iron and the zinc coating and resulting in the eating away of both. Sometimes the iron core and copper windings, in combination with the salt water, form an electrolytic cell which, in a short time, causes the complete failure of the transformer.

The remedy for such transformer trouble is to seal the units so that they are moisture-

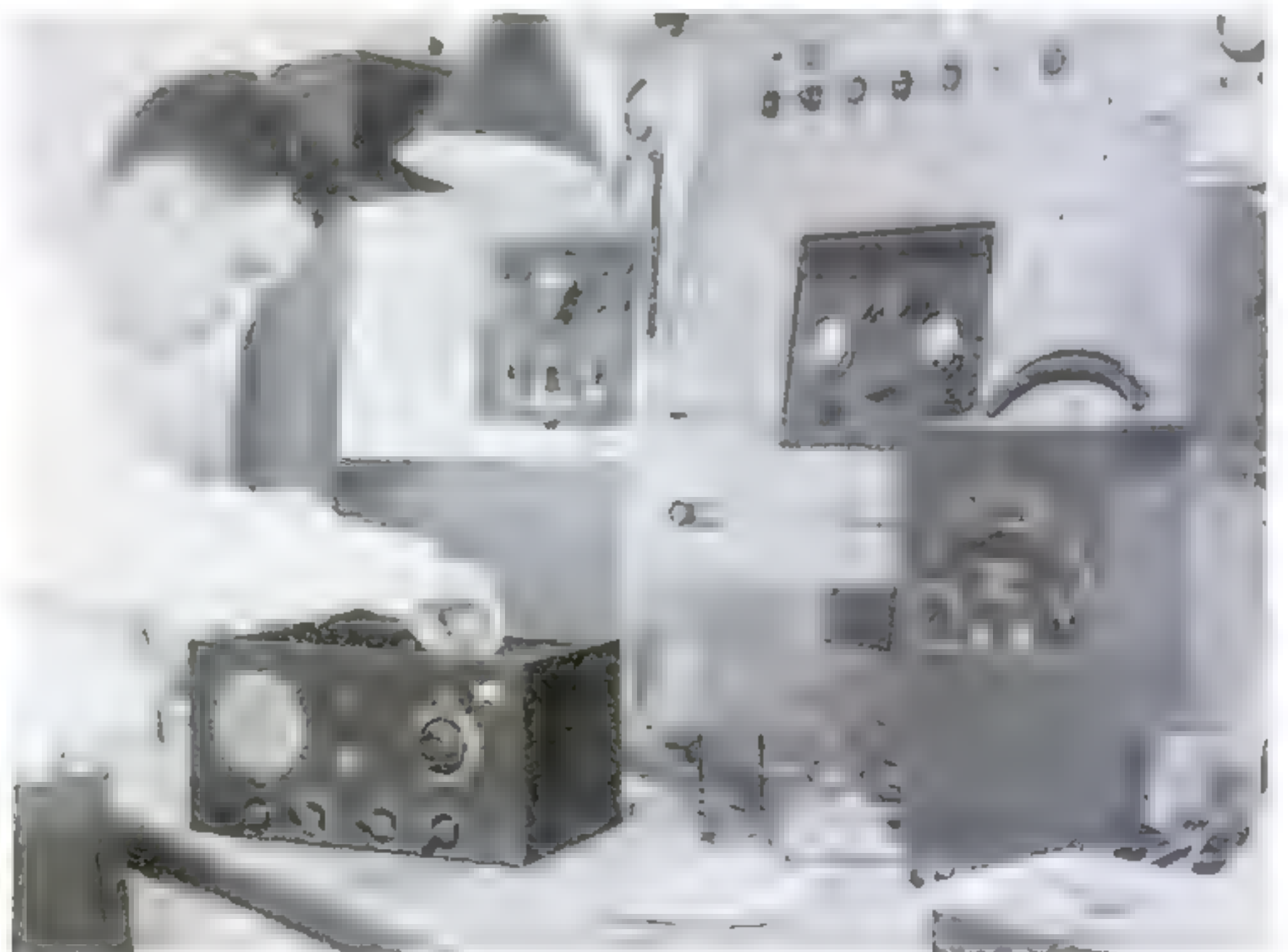
tight. If the transformer already has been treated with insulating varnish or paraffin, inspect it carefully. The protective coating may merely form a shell, and not penetrate to the center of the winding. Because the hollow shell serves only to hold moisture in contact

with the metal, such protection is worse than none at all. In such cases, the windings and core should be completely saturated with varnish or wax.

In treating an uncoated intermediate-frequency transformer, for example, dip it in paraffin and connect first the primary and then the secondary across a 22½-volt or a 45-volt "B" battery, leaving the windings shorted until they become hot, but not hot enough to damage the insulation. A little experimenting will make it easy to judge the degree of heating required. This warming of the windings causes the paraffin in the outer layers to penetrate to the innermost turn. The transformer finally is dipped again in a hot paraffin bath, to complete the sealing. Audio transformers can be treated in the same way, care being taken not to burn out the windings.

One of the main troubles that develop in boat receivers is caused by corrosion at the terminals of transformers and other parts where soldered connections are used. This occurs even when silver solder is employed. About the best remedy is to protect all joints with waterproof paint or other material, or to use welded connections.

Another common trouble that can be traced to salt water is the jamming of a loudspeaker, caused by an accumula-



The receiver should be specially prepared for service afloat before being installed on the boat

Goes to Sea



A radio-equipped cruiser. Note the cage antenna rigged from the mast. Right, control panel of receiver mounted near the center of the boat

tion of rust between the tiny voice coil and armature. This corrosion comes from the armature, and can be prevented by carefully coating the metal with lacquer thin enough to provide ample coil clearance.

Corrosion also can be blamed for the short life of brass contacts, such as switch points and switch blades. The best protection is to silver-plate the areas where contact is made, a procedure that usually is not very expensive. Silver is not attacked by salt, and provides good electrical connections.

GENERALLY, the antenna system on a boat radio will give little trouble from the standpoint of corrosion. In most cases, it is rigged high enough above the water to be out of reach of most of the salt spray, and what does collect dries quickly or is washed off by rains. Sometimes an aerial that provides more surface than a single wire is desirable. One of the best is a cylindrical cage-like affair made by soldering several strands of uninsulated wire to copper hoops, the wires being spaced equally around the hoops. The antenna lead-in should enter the cabin roof or side wall through a weatherproof insulator, as shown in one of the illustrations.

Some boats have fresh-water supply systems that are isolated electrically from the boat "ground" that includes the engine and propeller. Such a water system never should be used as a ground or an antenna for the radio set. If it is, electrolysis may be set up in such a way that screws in the boat's hull will be eaten away, or the propeller or other parts severely damaged. There is a remedy for the electrolytic action, however. It consists of tacking a sheet of



The receiver. It operates three loudspeakers

zinc to the boat bottom, keeping it isolated electrically from other metal parts. The best way of preventing any damage, however, is to ground the receiver to the frame of the boat engine or, in the case of sailboats, to some metal part that communicates with the water in which the craft floats.

Another problem that generally has to be solved in connection with the use of receivers on motor boats, whether in salt or fresh water, is the suppression of interference from the engine's ignition system, fan motors, and other

auxiliary electrical equipment, and from similar sources on other boats that may be moored within a radius of 300 feet or so. This is the same problem that confronts the owners of automobile radios.

A well-shielded antenna lead-in, with the shielding grounded to the motor frame, will do much to eliminate troublesome outside noise if the receiver itself is of modern construction and adequately shielded. Interference from spark plugs and other parts of the boat's own engine ignition system generally will not affect radio reception if the receiver is powered by a separate battery, in which case a simple switching arrangement should be provided so that the auxiliary battery can be connected to the engine generator or to a separate direct-current generator for charging.

As in home installations, small electric motors are a common cause of interference. *(Continued on page 119)*

More Power to Your Car

"THIS bus has about as much power left in it as a flea—and a sickly flea at that," grumbled young William Barton disgustedly, as he shifted back into high gear at the top of the hill.

"Billy, you're the limit," snapped his good-looking bride. "With all this perfectly beautiful scenery to look at, all you can think about is that miserable engine. I wish we had come by train!"

"So do I—or I will pretty soon, if this motor doesn't begin acting better," Bill growled. "But don't let's quarrel about it, honey," he added with a smile. "You admire the scenery and leave me to worry about the motor. Just be thankful you don't have to take an eye-ful of cinders with the scenery!"

"Do you really think it is getting any worse?" she asked. "Because, if it is, maybe that funny hissing noise I hear has something to do with it."

"What funny hissing noise? Do you hear it now?" Barton demanded, cocking his head first to one side and then to the other.

"No—only when you push on the accelerator," she replied. "Step on it quickly now, and listen."

They happened to be passing a high bank at the side of the road as Barton jammed the throttle pedal to the floor, and a strong hissing noise was very noticeable.

"Gosh!" he exclaimed. "I'll bet I know what the trouble is. Probably the muffler is all clogged up. We ought

By MARTIN BUNN

to stop and have that fixed. It's just wasting gas, as well as taking all the power out of the motor."

A few minutes later, they sighted the Model Garage, and Gus Wilson, half owner and mechanic, greeted them as they pulled in.

"I'll just run over there and send out a flock of post cards while you have it fixed," said the bride, as she caught sight of a drug store down the street.

"Don't forget to tell them how fine the car is running," laughed Barton, turning again to Gus.

"Muffler seems all clogged up so she has no power," he explained.

The veteran mechanic stretched himself out on a creeper and slid under. "Step on the accelerator now," he ordered. In a second or two he slid out again and went around to the back of the car. "How did you do that?" Gus asked, pointing to the end of the pipe.

Barton got out and came around to the back of the car. He saw that the end of the exhaust pipe evidently had hit a rock or some other object projecting from the road, so that the opening had been crushed to a tiny semicircular crack.

"The outside shell of your muffler is rusted through in one place," Gus informed him, "so when the pipe got bashed closed like that, the back pressure made the gas hiss through the hole

in the shell. I'll fix you up in a jiffy."

With a screw driver, he pried open the closed end of the pipe enough to start the rounded end of a ball-peen hammer in the opening. Then, with another hammer, he drove the ball into the pipe, expanding it and making it nearly as round and full as when it was new.

"Simple enough, when you know how to do it," laughed Barton. "That ought to bring the power back a bit, but shouldn't something be done about that hole in the muffler?"

"Why bother?" Gus questioned. "The gas hissed through the hole only because it couldn't get out the regular way. You'll find it doesn't hiss now that the tail pipe is open. I could strap a piece of sheet asbestos over the hole with a band of sheet iron, but that would only speed up the rusting of the rest of the shell, and it wouldn't be long before it rusted through at some other spot.

"You don't hear much noise right now because of the hole, and I've seen mufflers go along for a year or two with a hole in them like that without getting much worse. When it finally breaks open, so you can hear the snap of the exhaust, then you can put on a new muffler. They don't cost much," Gus concluded.

"Well, I suppose you can't expect much power from a secondhand car, anyhow," Barton remarked. "Soon as I can get enough money together, I'll have to get a new one, and then I'll have some real power!"

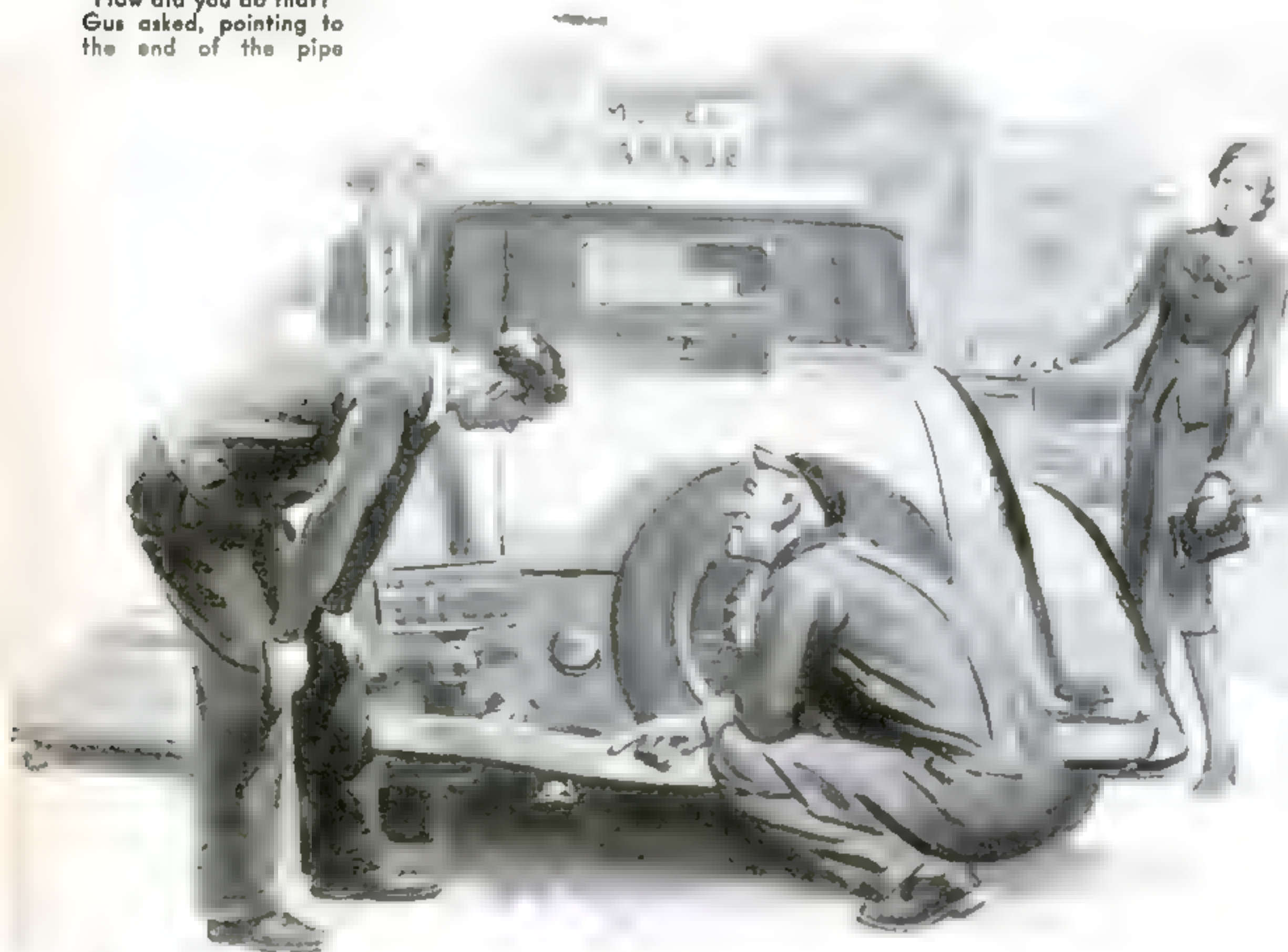
"Fine idea to get a new car, mister," Gus commented, "but don't get the notion that because a car is secondhand it has to be weak on power. The trouble with most people who buy secondhand cars is that they just take them as they are without ever giving a thought to what could be done to put them back in good shape as far as power and smooth running are concerned."

"How do you mean, put in shape?" Barton asked. "Isn't loss of power and speed caused by general wear on the motor? How can you fix that without practically putting in a new motor?"

"Why do that?" Gus countered. "Just stop and think what makes a gasoline motor go. The piston goes down and draws in a charge of air and gasoline vapor. Then

(Continued on page 121)

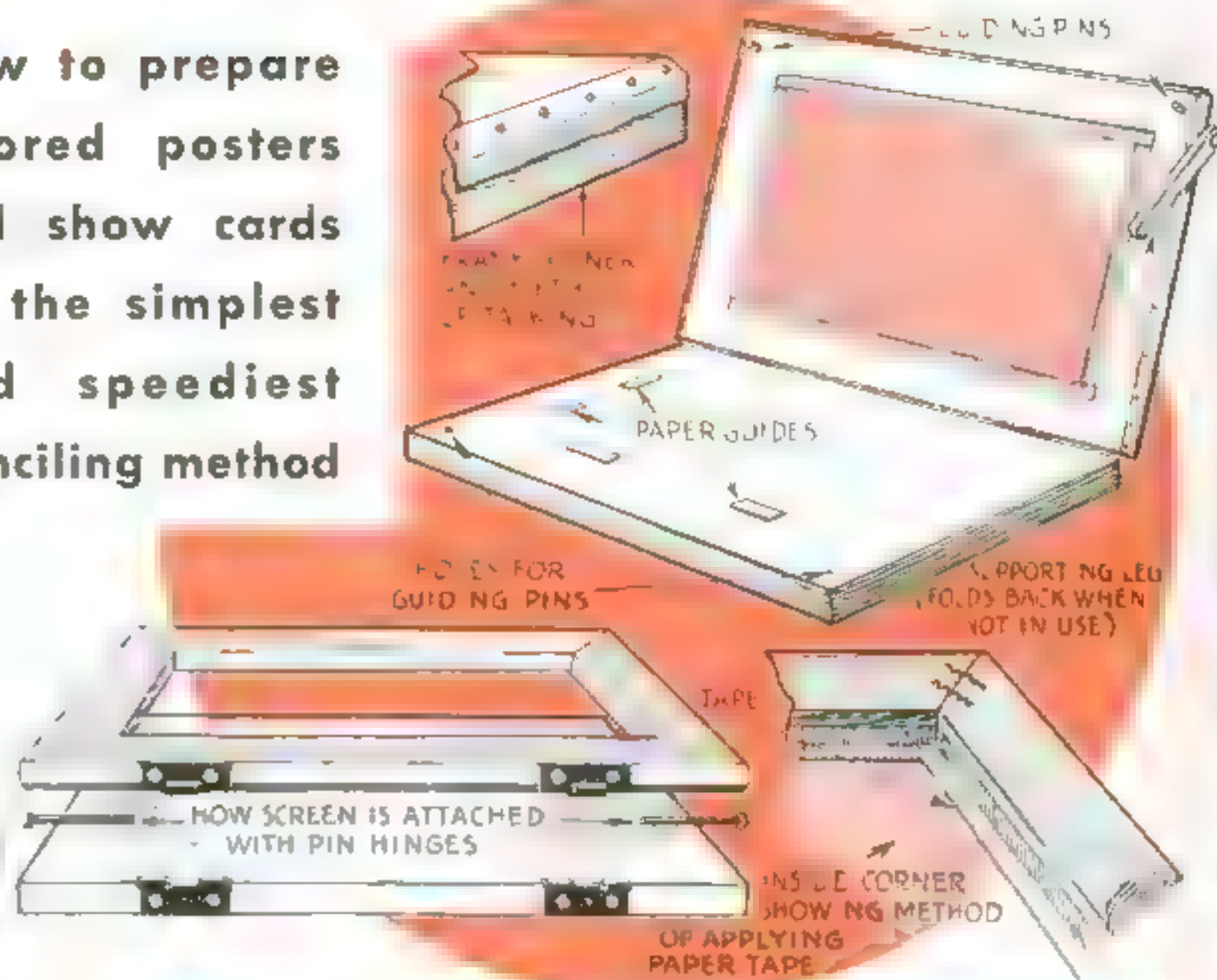
"How did you do that?" Gus asked, pointing to the end of the pipe



THE HOME WORKSHOP



How to prepare colored posters and show cards by the simplest and speediest stenciling method



The thick mass of paint is drawn across the back of the screen with a squeegee. A single well-regulated stroke is sufficient

Silk-Screen Printing

By KENNETH M. SWEZEY

DO YOU ever need quantities of attractive posters to advertise an amateur theatrical show, club party, or home workshop exhibition? Would you like to know a way to earn extra money printing show cards and posters? Then you should get acquainted with the silk-screen process. It is, in essence, a process in which thick paint is forced, by means of a squeegee, through a stencil attached to a tightly stretched screen of silk or other suitable material. It is simpler and more rapid than ordinary stencil printing and leaves no troublesome connecting links to be touched out.

By repeated printings, through properly cut and registered stencils, any number of colors may be applied. The method may also be extended to print on wood, metal, celluloid, fabric, glass, and other materials.

The essentials are a wooden frame, a baseboard or wooden table top, ma-

terial for a screen, loose-pin hinges, tacks, gum-paper tape, artificial shellac, a squeegee, and the necessary paint and paper or poster board.

For making a small frame, 1 by 2-in. furring strip is excellent; 2 by 2's would be better for a larger frame. The inside dimensions of the frame should be large enough to allow a margin of about 4 in. at each end and 2 in. at each side beyond the largest poster you intend to print. Plane a ¼-in. bevel around the outer edge of one of its sides.

The baseboard may be made from an old drawing or bread board, or the frame may be hinged directly to a wooden table top. Loose-pin hinges are used so the frame may be detached instantly for inspection or cleaning.

For screens, professionals generally use stencil silk or silk bolting cloth. The former costs about \$3 a yard, the latter from \$6 to \$10. Both may be bought from any large dealer in art

supplies. For the limited requirements of the amateur, however, ordinary white organdie, costing only 40 or 50 cents a yard, may be used.

Whatever the material, it must be stretched as tightly as possible over the frame and tacked along the bevel. Turn the frame over and seal the inside juncture of frame and cloth with cellulose tape or adhesive paper tape. Apply a strip of tape over this, on the outside.

With the frame hinged to the baseboard and closed down, drive a nail through each of the sidepieces of the frame right into the baseboard about ¾ in. deep. Pry the frame from the base, clip off the sharp points of the nails, and enlarge the holes in the base a trifle. These nails and holes will insure accurate register.

To support the frame between printings, make a leg of wood, 6 or 8 in. long, and attach it with a single screw to the right of the frame, as shown.



Tracing paper is attached smoothly to the original design with rubber cement; then artificial shellac is applied to the tracing paper. Above, drawings showing construction of printing frame

The simplest way to make a stencil is to paint it directly on the screen with lacquer, shellac, or enamel. This method, however, leaves a slightly ragged edge. Other methods involve loose paper stencils, photography, and patented transfer films. The following is a proved method, easily carried out, that produces clean-cut results:

First draw your lettering and design in detail on a piece of cardboard or poster board the exact size of the poster-to-be. If it is to be of more than one color, the design may be painted in the desired colors, or colors may be merely indicated with a dash of crayon.

Fasten a sheet of tracing paper smoothly over the finished design with a thin coating of rubber cement. Allow the rubber cement to become partly dry before attaching the tracing paper. Now give the upper side of the tracing paper a coat of artificial shellac. This

comes under various trade names and is recommended for screen work because it may be washed out more easily than real shellac.

Next, choose the first color you wish to print and carefully cut through the outlines of all the parts of the design of that color. Use a sharp knife and barely cut through the tracing paper. The parts of the stencil that are to be open should then be peeled from the cardboard.

Now take your original, with the stencil on it, and center it on the base-board. Four little rectangles of cardboard, the same thickness as your poster, are glued to the base as shown to act as guides.

Without disturbing the original, the frame is closed upon it, several thicknesses of newspaper are laid on the inside of the screen, and the screen is pressed into contact with the stencil

The mounted tracing paper is cut with a sharp knife



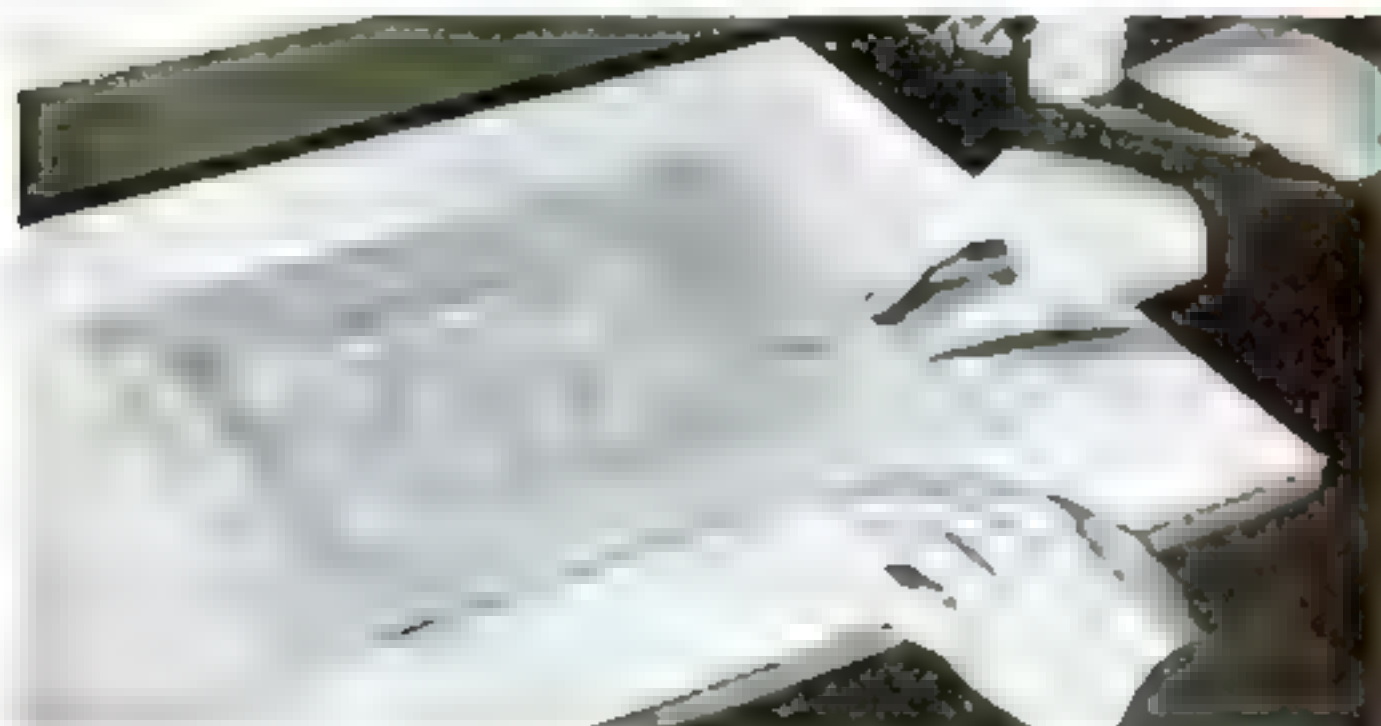
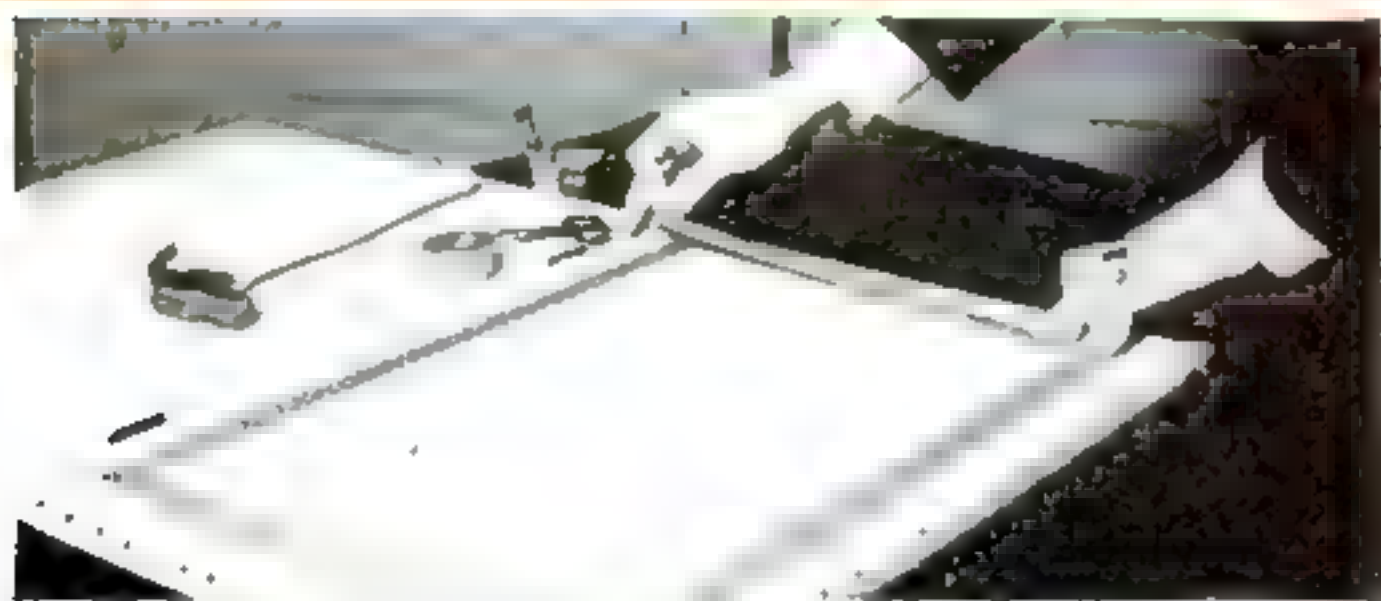
with a warm flatiron. If properly done, the stencil becomes firmly attached to the underside of the screen, and the cardboard original may be peeled from it. Any mishaps to the stencil may be patched with bits of tracing paper and shellac. Fill the space between the stencil and the frame with a coat of shellac.

The essentials for a good paint are that it be thick enough not to run, yet thin enough to go through the screen without clogging; it must have body, and it must not dry too quickly. Beautiful oil colors, prepared especially for silk-screen work, may be bought in large paint stores. In a pinch, ordinary flat oil paint may be used. First allow it to stand twelve hours or more, skim off the oil that floats on top, and add a little litho varnish. For silk-screen use, paint must be as thick as apple sauce.

Good water-color paints may be made by adding dyes or show-card colors to a base of molasses or corn syrup mixed with thick starch paste, with a little glycerin added to prevent too rapid drying. Proper consistency must be determined by experiment.

To print, dump a quantity of paint into one end of the frame, raise the frame, place a poster sheet against the guides, and lower the frame again. Then place your squeegee blade behind the mound of paint and draw it with an even stroke across the back of the screen. An ordinary window squeegee will serve the purpose, although special squeegees are made for screening. By varying the angle of the blade in relation to the screen, the amount of paint forced through may be controlled. For the next poster, the squeegee is drawn back the other way, and so on.

After the entire run is made with the first color, the remaining paint should be washed out and the stencil removed with alcohol. The stencils for the second and succeeding colors are made and mounted exactly as the first stencil.



First paper tape is applied to edges inside and outside. Second centering the drawing and stencil. Third heating screen to make stencil stick. Fourth, shelling the margin



SOLID SCALE MODEL OF THE "MILES MOHAWK" Lindbergh's Latest Plane



Above is a photograph of the finished model with an airport painted in. Left, assembling the wings. Below, the drawings

HERE is a model of the plane now being used by Colonel Charles A. Lindbergh. It was in this ship that he and Mrs. Lindbergh made a leisurely trip from England to India and back earlier this year.

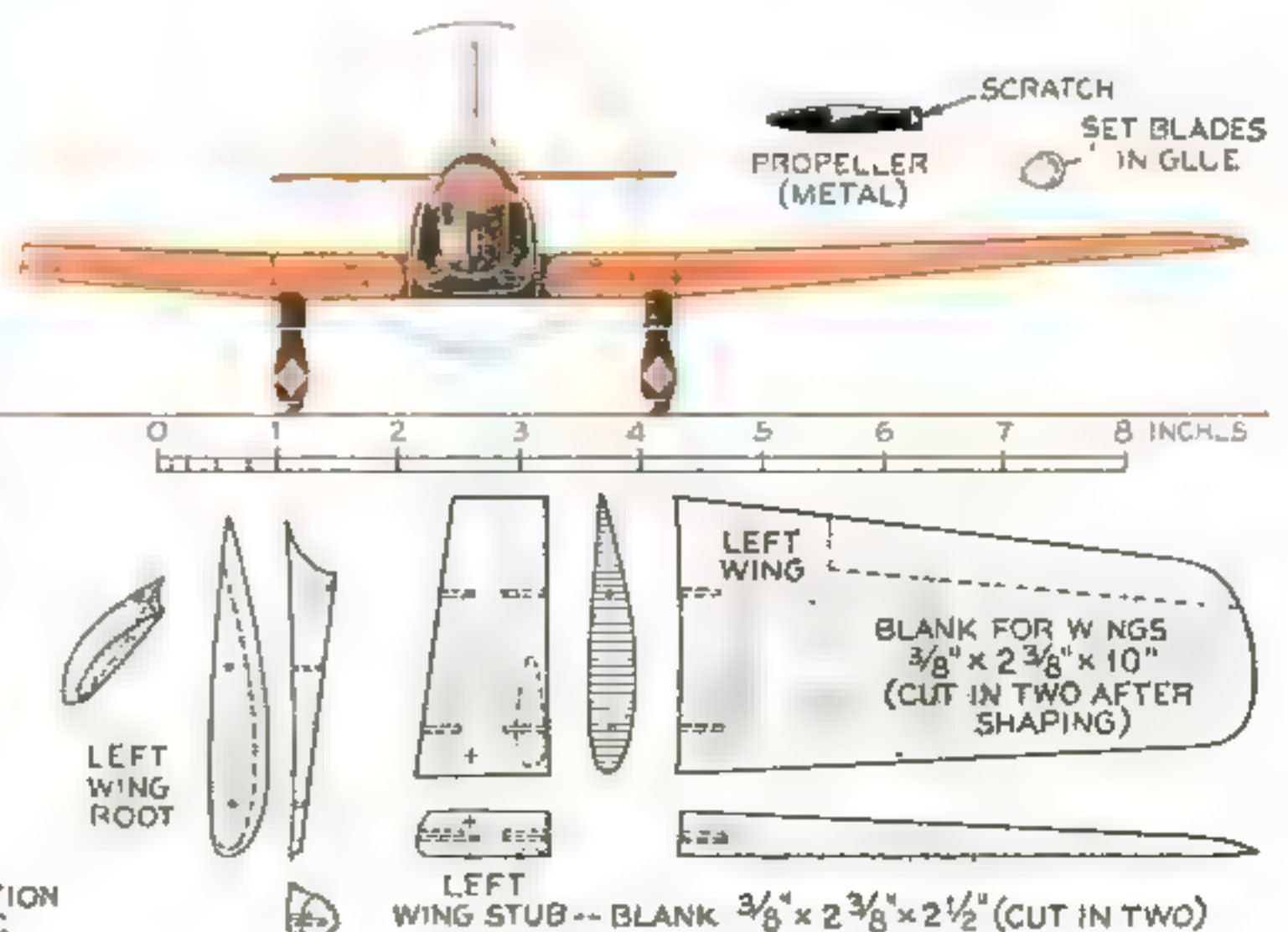
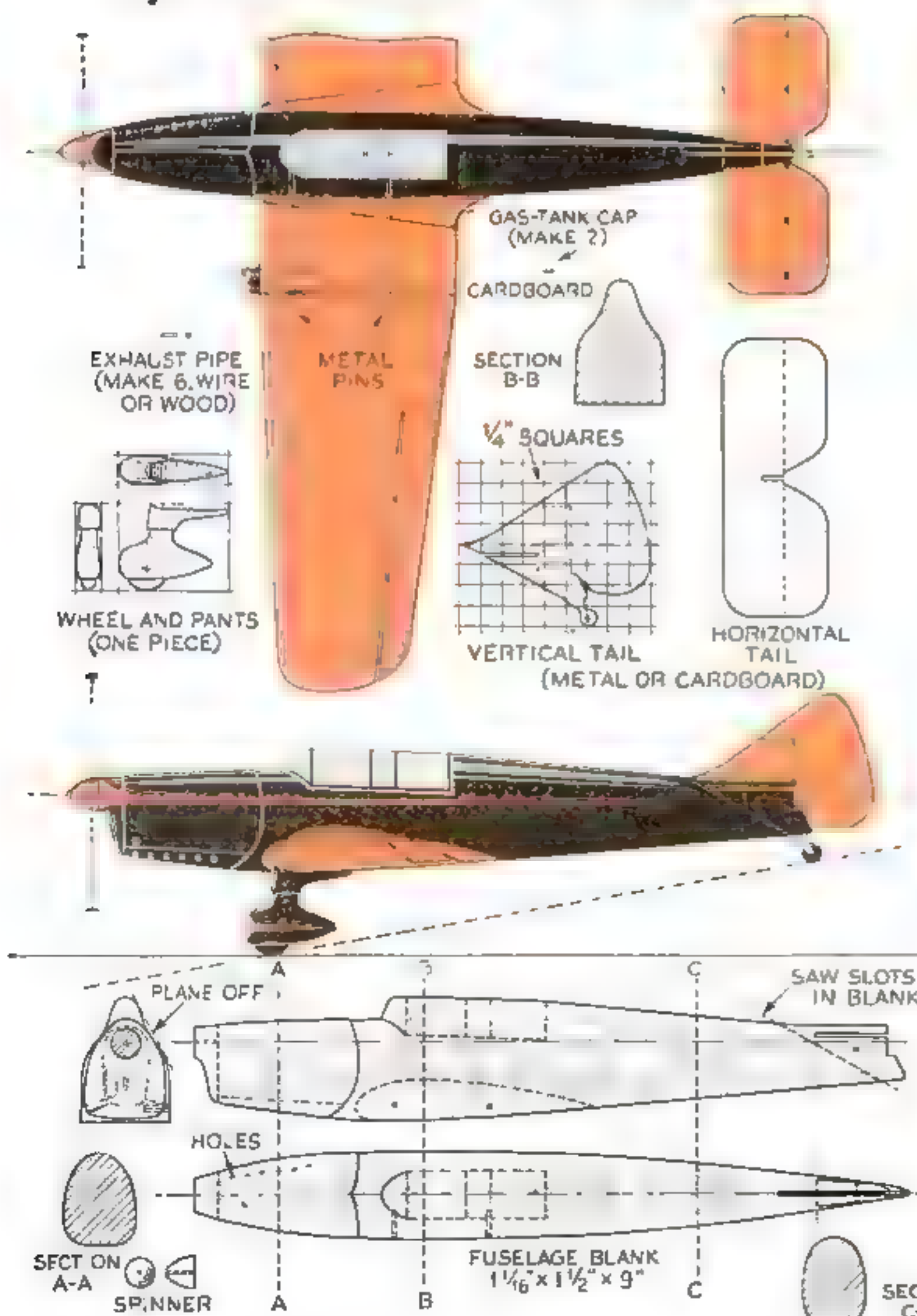
The plane was built especially to meet Colonel Lindbergh's requirements after conferences with F. G. Miles, director and chief designer of a British firm, and it is known as the "Miles Mohawk." It is powered by a supercharged American-built Menasco Buccaneer engine rated at 200 h.p. The wing span is 35 ft., overall length 25 ft. 6 in., height 6 ft. 6 in., weight empty 1,605 lb., useful load 1,095 lb. The plane is registered as G-AEKN.

Built to our usual scale of $\frac{3}{8}$ in. equals 1 ft., the model requires fourteen parts. The only two that are in the least difficult to make are the wing roots.

The propeller spinner can be made as part of the fuselage if desired; this was done in the case of the original model shown in the photograph. Drill six holes as indicated to take the exhaust pipes. Small cardboard disks glued to the wing stubs represent the gasoline-tank caps.

Fuselage, wheel mounts, tires, and all details are black; wings, tail, and trim, orange; windows, gray. Another color scheme that would bring out the graceful lines would be: fuselage and wheel mounts, pine green; wings, tail, propeller, and trim, cream; tires, hinge lines, and details, black; windows, gray.

By DONALD W. CLARK

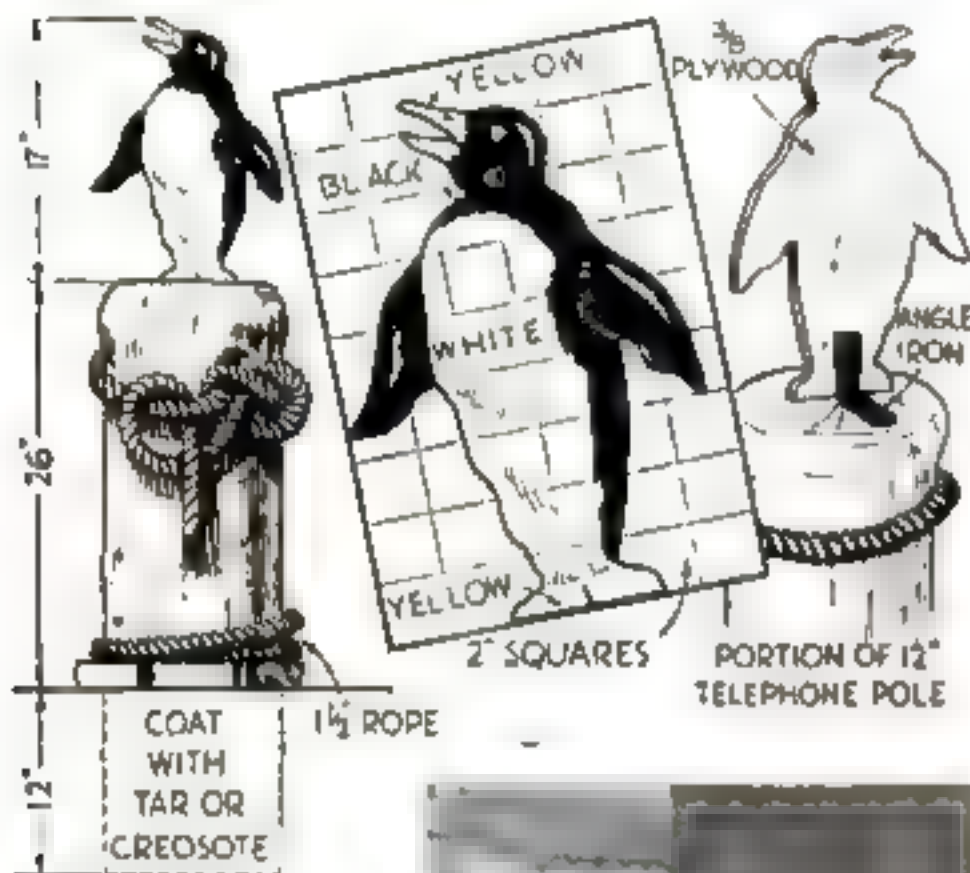


Wooden Penguin Guards Beach Cottage

MOUNTED on a post hung with a hawser, the scroll-sawed penguin shown below bids welcome to guests at a beach cottage.

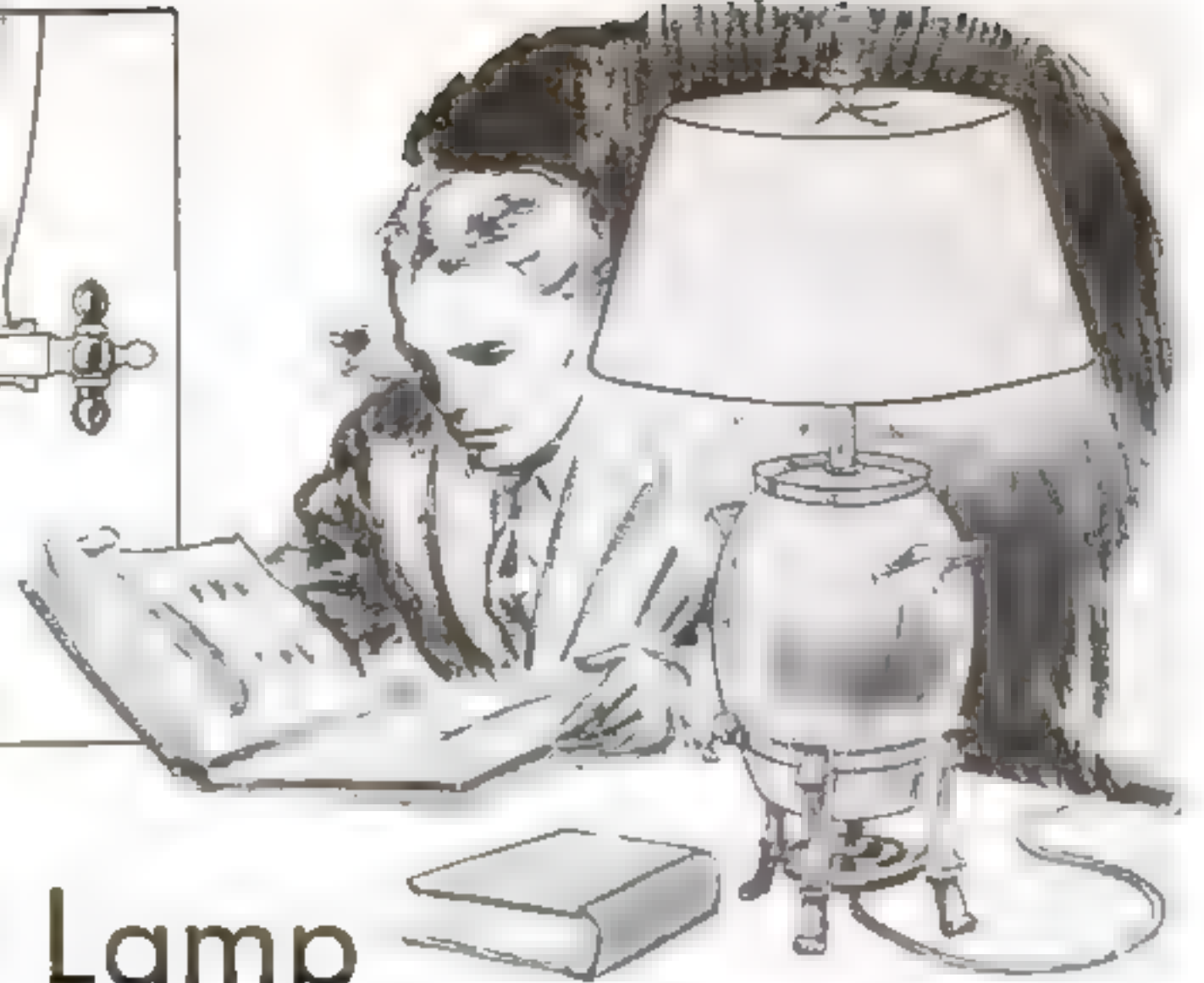
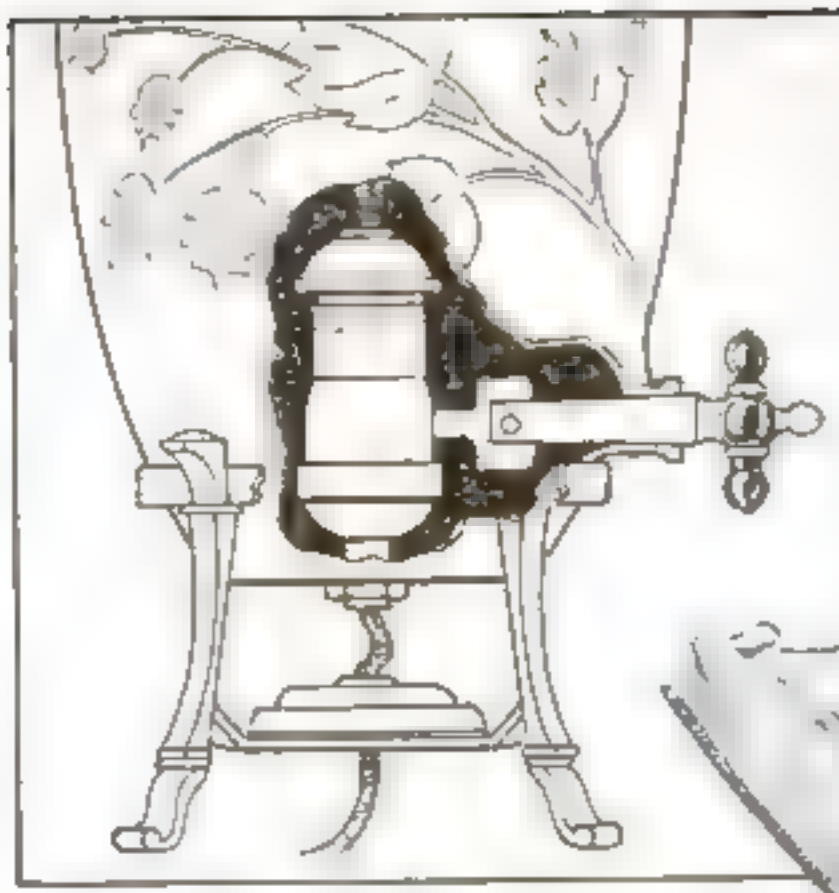
Cut the penguin profile from $\frac{3}{8}$ -in. waterproof plywood and paint as indicated. Use high-grade outside enamels after the ground or filler coat is dry; or if only flat-drying colors are available, apply a finishing coat of spar varnish to give a sleek, glossy effect.

Round the upper end of the post with a hatchet or adz. If you have no bit for making the large hole, bore a smaller one and burn it bigger with a red-hot iron bar.—H. S.



How the penguin is shaped, colored, and mounted, and a suggestion for decorating the post with rope

In this case the ornament is set up in a patio. If it is placed in the open, the plywood must be well painted, especially on all the edges



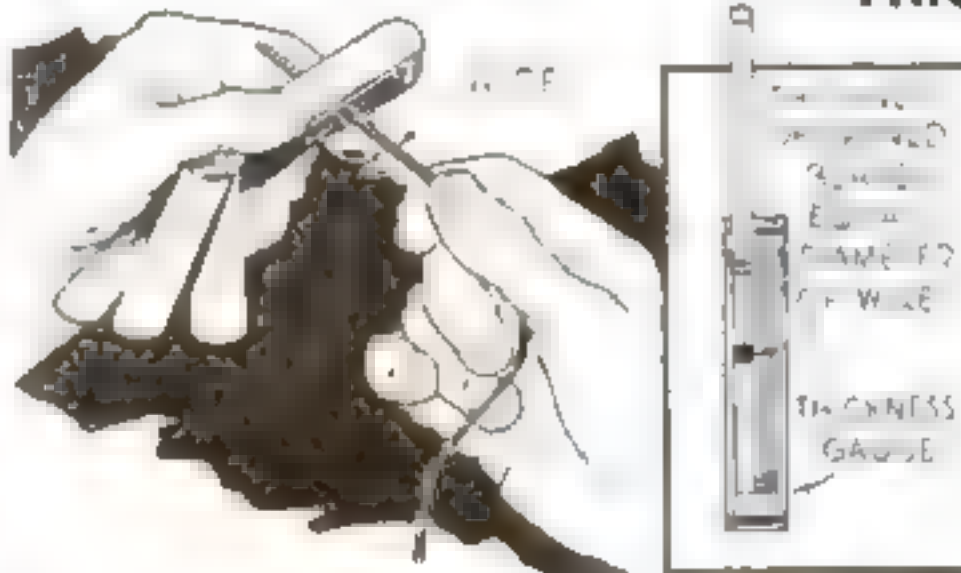
Beautiful Lamp Made from Old Coffee Urn

COUNTLESS silver-plated coffee urns of the alcohol-burner type popular from about 1850 to 1880 are stored away in attics and junk shops. When converted into a table lamp as shown, they become objects of beauty and utility. One such lamp was recently purchased by an interior decorator for thirty dollars.

The worst of the tarnish can be removed by immersing the urn in a large vessel filled with boiling water in which two or three tablespoonsful of ordinary soda have been dissolved. Place a fair-sized piece of aluminum in the bath and, if necessary, continue boiling the water for a few minutes. Take care,

however, not to let the urn touch the bottom of the vessel near the flames, as the base metal melts easily. Any necessary soldering has to be done cautiously for the same reason. Complete the cleaning with silver polish.

In the case of the lamp illustrated, the spigot was adapted for turning a standard electric switch, as shown in the enlarged detail. In reworking the cover of the urn to take the tube for the cord, the knob was sawn off closely and used as a finial on the upper end of the tube. The lamp shade is 12 in. in diameter. A plain or pleated shade of good quality parchment, either cream or white, looks best.—A. GUDMUNDSON.



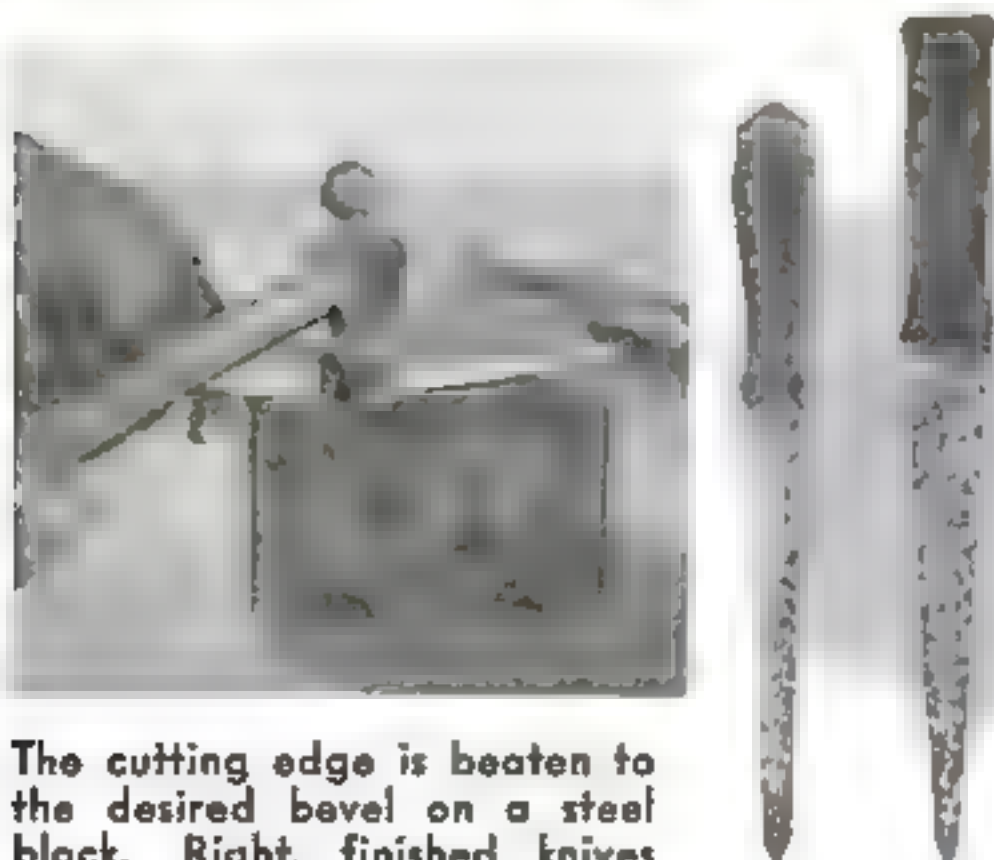
Thickness Gauge Measures Wire

AN ORDINARY thickness gauge can be used in an emergency to determine wire sizes, drill diameters, and the thickness of sheet metal with sufficient accuracy for ordinary purposes. It is necessary only to open the blades, insert the object, and put back as many blades as will go without applying much force. The sum of the readings on the blades still out is the diameter.—W. C. W.

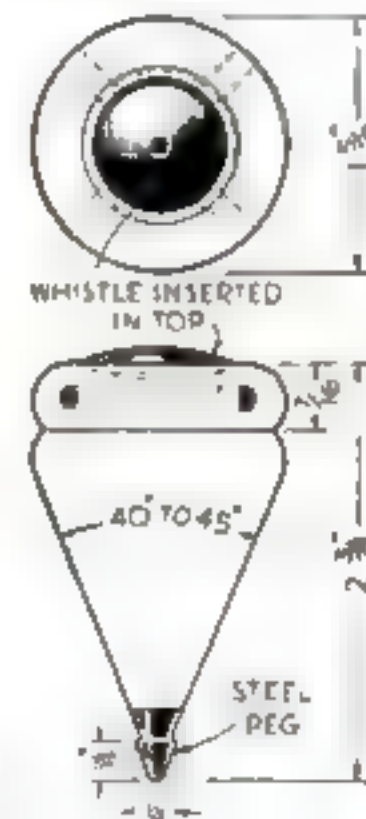
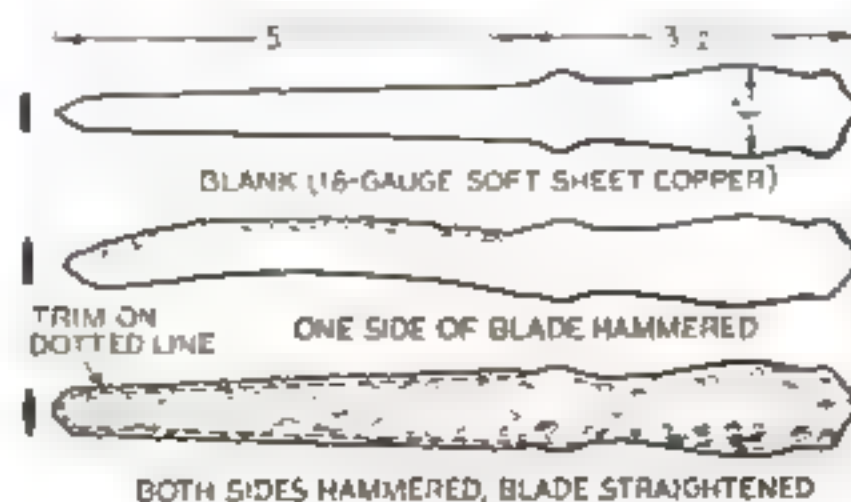
Hammered-Copper Letter Knives

ATTRACTION, salable letter knives can be hammered quite easily from 16-gauge soft sheet copper. The engraving on the handle of one of the knives

illustrated was done with a small cold chisel. The handle shaped like a horse's head was cut from sheet lead and riveted on with escutcheon pins. Another knife has a separate handle, riveted on. Color the knives in water in which a small piece of liver of sulphur has been dissolved. Then wash, polish and lacquer.—DICK HUTCHINSON.

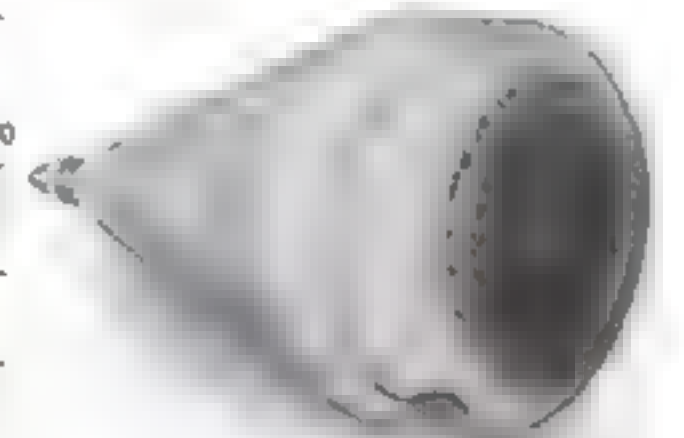


The cutting edge is beaten to the desired bevel on a steel block. Right, finished knives



Homemade Top Gives Out Long, Shrill Whistle

A WOODEN top that whistles as it spins may easily be made as shown. An old-fashioned tin whistle is inserted in the top, and four holes are drilled through from the side. The top in the photo was turned from maple, and as no whistle was available, a wheel from a toy train was used.—D. R. DOREMUS.



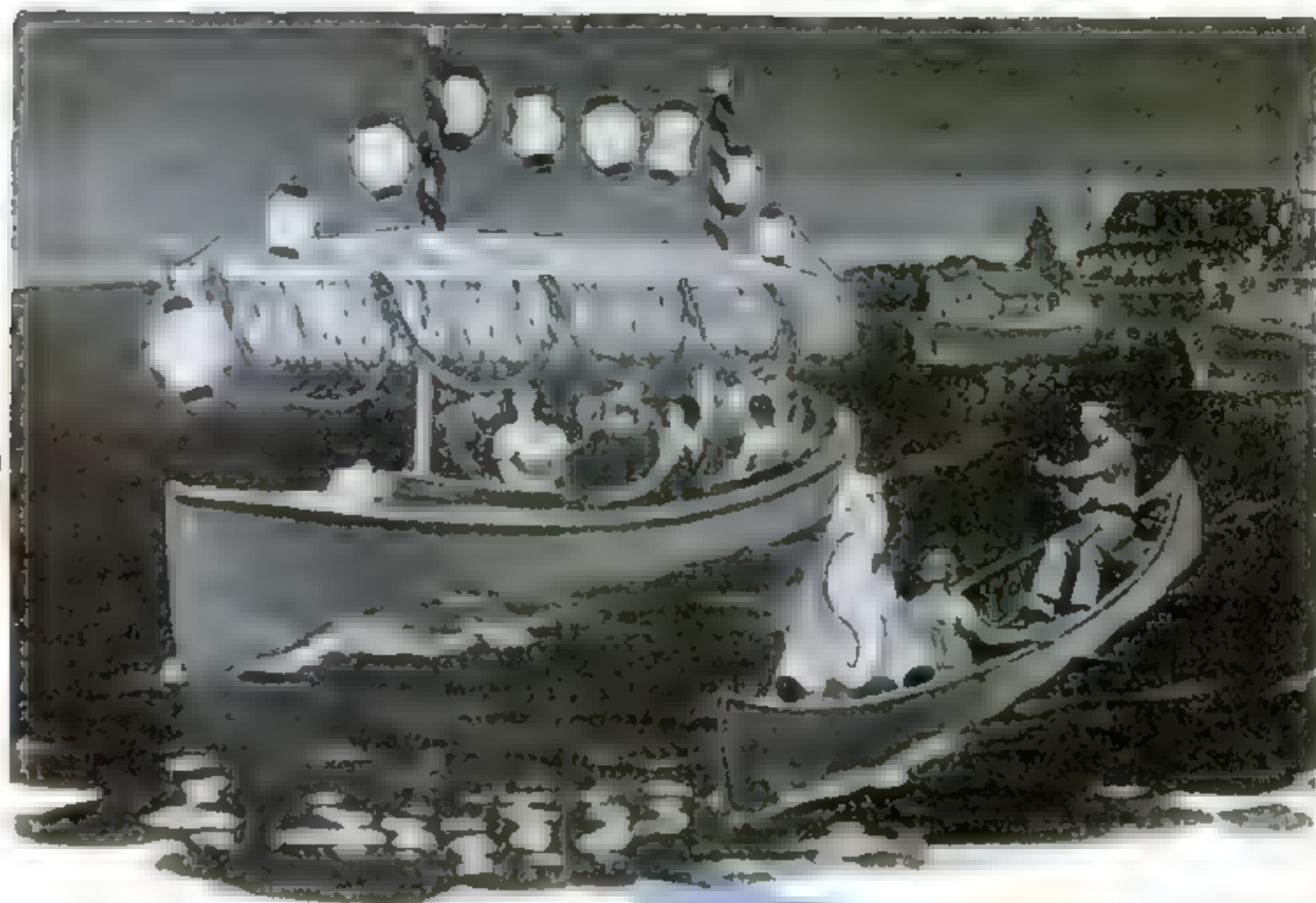
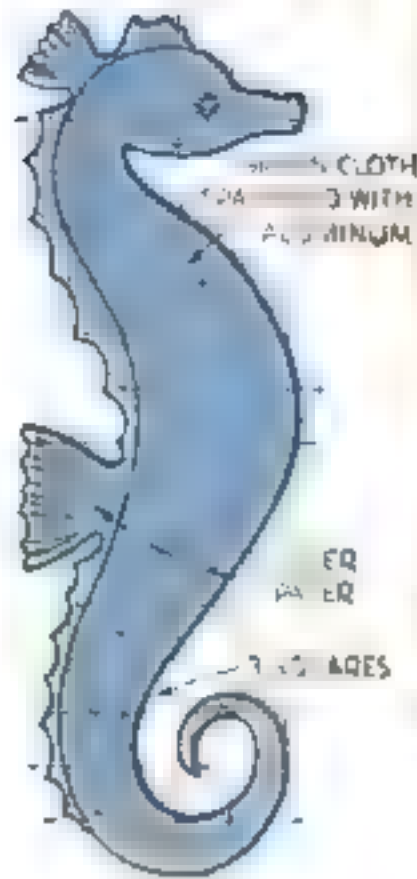
ILLUMINATED DISPLAYS FOR A Water Carnival

NOVEL ways to decorate a canoe, boat, or float for a water carnival are suggested in the accompanying illustrations.

With spotlights focused upon it, the sea horse makes a striking display. The profile is scroll-sawed from plywood as shown in the drawings. A cover is made from green cloth and padded out with excelsior. Two thicknesses of silver paper serve for the fins, and ruby reflectors for the eyes. The creature is mounted upon three strap-iron legs. Aluminum or bronze paint is spattered over the cloth covering, and the legs are painted dull black.

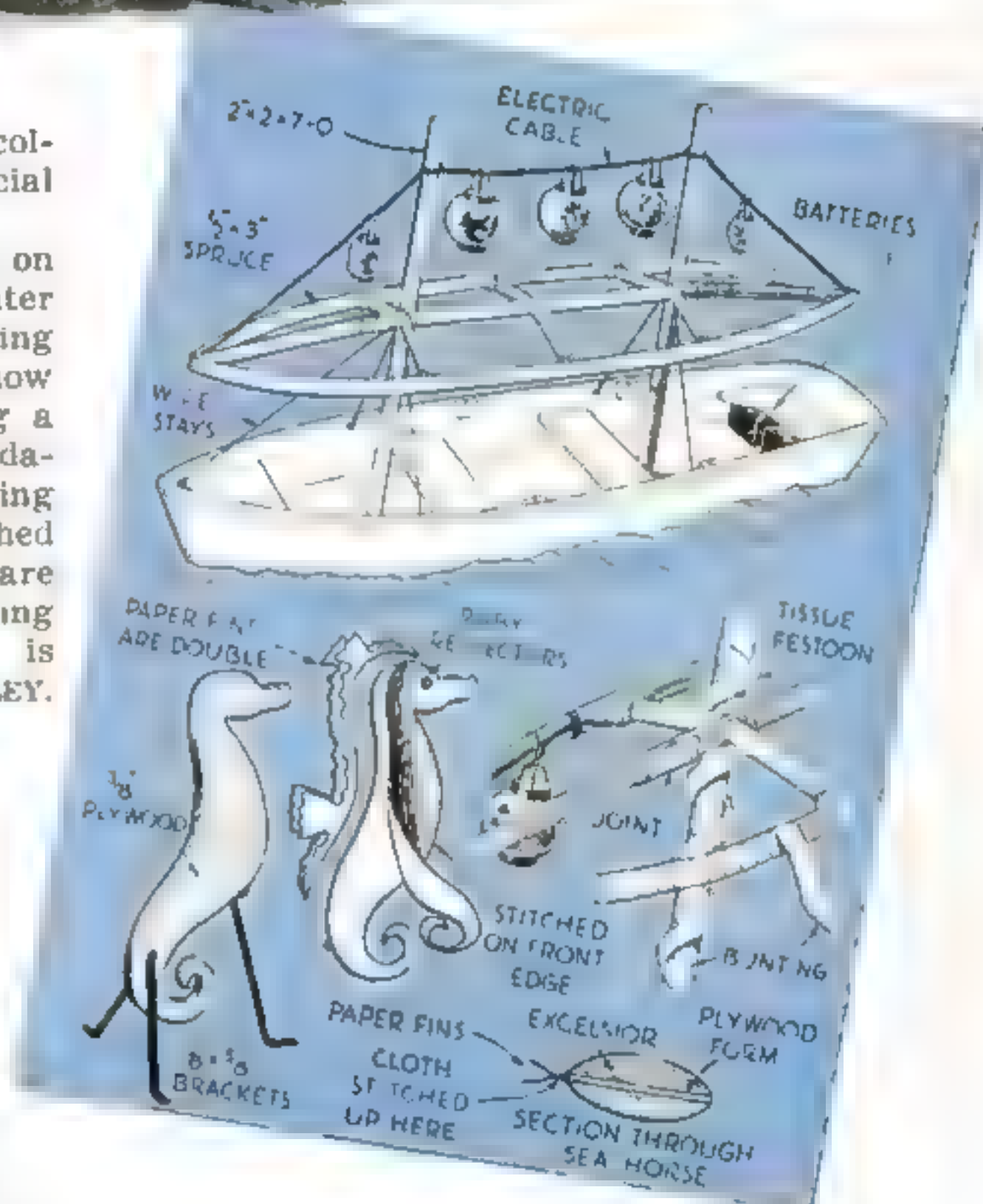
A canopy of the type shown is suitable for a power boat or a sailboat with the mast unstepped, or it can be erected on a rowboat and towed. Storage batteries and 8-volt bulbs are used to light the lanterns, and bunting, paper fringes, and tissue festoons add to the gay effect.

If illuminated by outrigger lamps, a

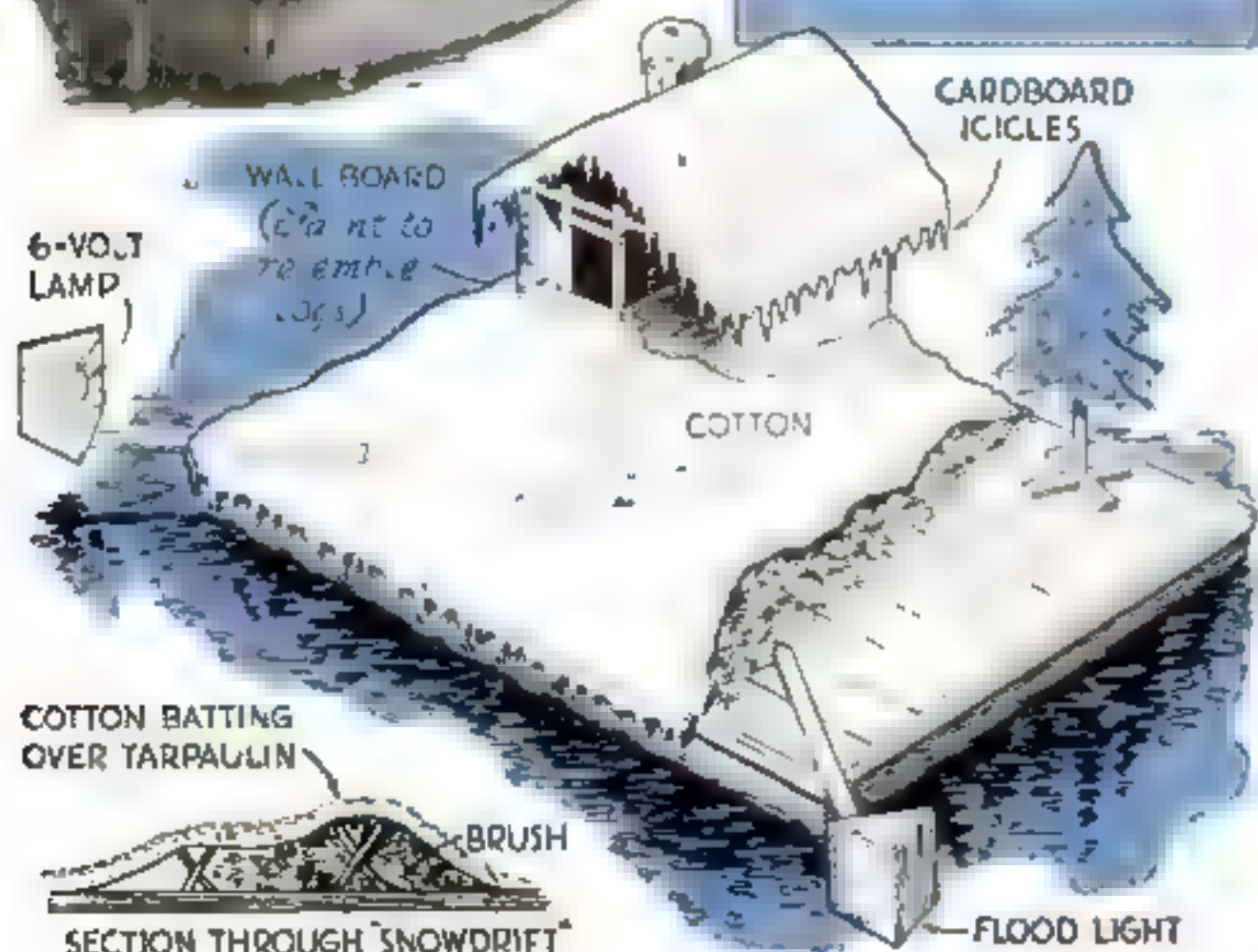
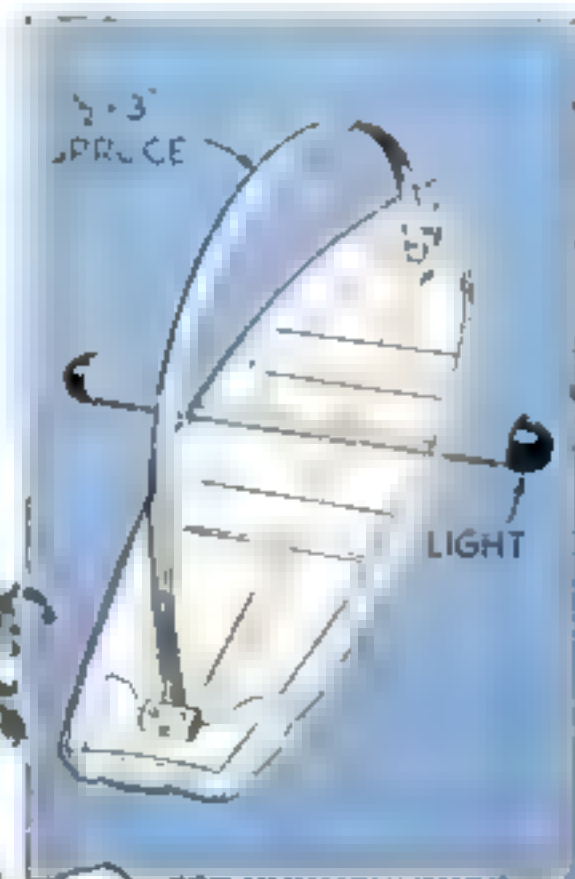


huge flower basket forms a colorful display. Real or artificial flowers may be used.

Nothing is more impressive on a hot August night than a winter scene constructed on a landing float or small barge. The snow drift is formed by throwing a tarpaulin over an uneven foundation of brushwood and covering it with cotton batting, stitched here and there. The icicles are white cardboard, and sparkling Christmas artificial snow is sprinkled over all.—HI SIBLEY.

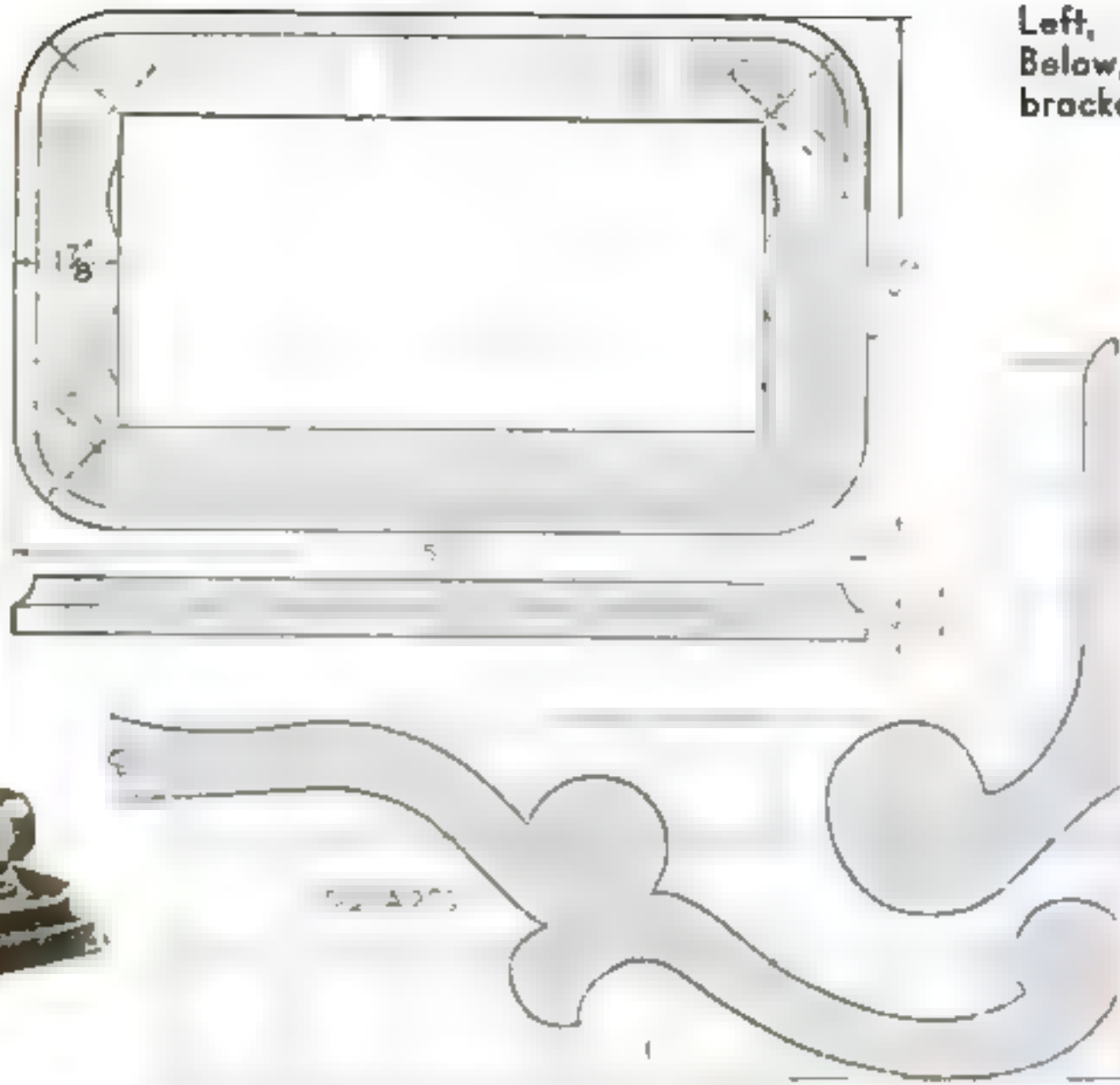


Suggestions for constructing a variety of floats



Sparkling snow scene built to defy scorching August days. When illuminated at night, it makes a brilliant and novel addition to any water pageant

HOT-WEATHER



Left, the finished tray and parts. Below, sanding depressions. Oval, brackets and handle are jig-sawed

Muffin-Pan Tray Carries Glasses

EVERY one who has tried to carry a tray loaded with glasses will appreciate this design. The tray is built around either an aluminum muffin pan or one of tin, left bright or enameled.

To hold the pan, make a frame of 1-in. wood with mitered and doweled corners. After being assembled, the corners are rounded to a radius of $1\frac{1}{2}$ in., and the edge is molded. Make the frame slightly smaller than the pan under the rim. Cut rounded depressions

in the inside for the individual pans.

The end brackets are jig-sawed from $\frac{3}{8}$ -in. wood. The notch in the top is made a tight fit on the handle, which should be plywood or pressed composition board. The brackets are fastened to the frame with screws from beneath. The handle is then forced into the slots and pinned. If a good hardwood has been used, a rubbed varnish finish is desirable, but a soft or cheap wood should be enameled.—D. C. M.



Playing-Card Box Resembles Book

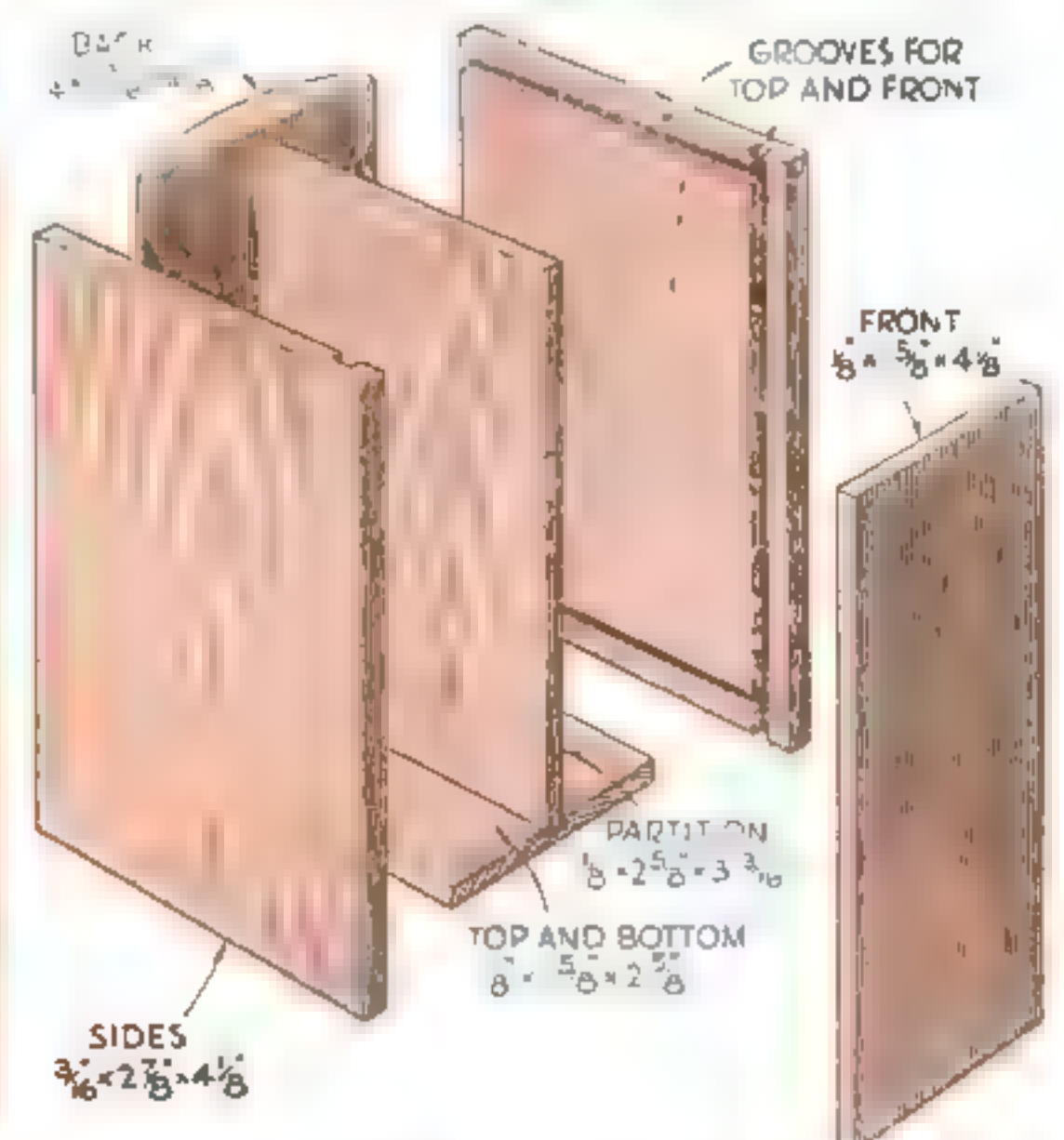
PLAYING cards need not be tucked away in a drawer if you have one of these novel boxes. Shaped like a book, it holds two packs of cards and looks well on the table or mantelpiece. It won third prize for the New Bedford (Mass.) Woodcraft Club in a recent three-hour project contest of the National Home-workshop Guild (see P.S.M., July '37, p. 82).

Basswood was used for the original box, although any scraps of wood will

do. No nails are used, only glue. The top and bottom pieces fit into grooves in the sides, and the back is glued on. Slots are cut in the top and bottom to hold the middle partition in place. The edges are gilded, and the remainder may be painted or stained as desired. The name of some popular novel printed on the back and front helps to further the illusion that it is a miniature book.



Constructed as at right the wooden book has a sliding front that gives access to two packages of playing cards



Because of its clamping action, the holder will grip loose paper sheets

Holder for Note Pad and a Small Calendar

AN ADVANTAGE of the calendar and note-pad holder illustrated above is that it will also hold loose sheets of paper neatly together—just as well, in fact, as if they were padded. Use a strip of light spring brass or similar metal and cut an opening in one end to serve as a window for the small calendar pad. After soldering a retainer or metal pocket at the back of the window to hold the calendar, bend the piece around a broom handle or large dowel so that the note paper will be held tightly as if by a spring—K. L. ROBBINS.

Soldering pocket for calendar pad

CRAFTWORK

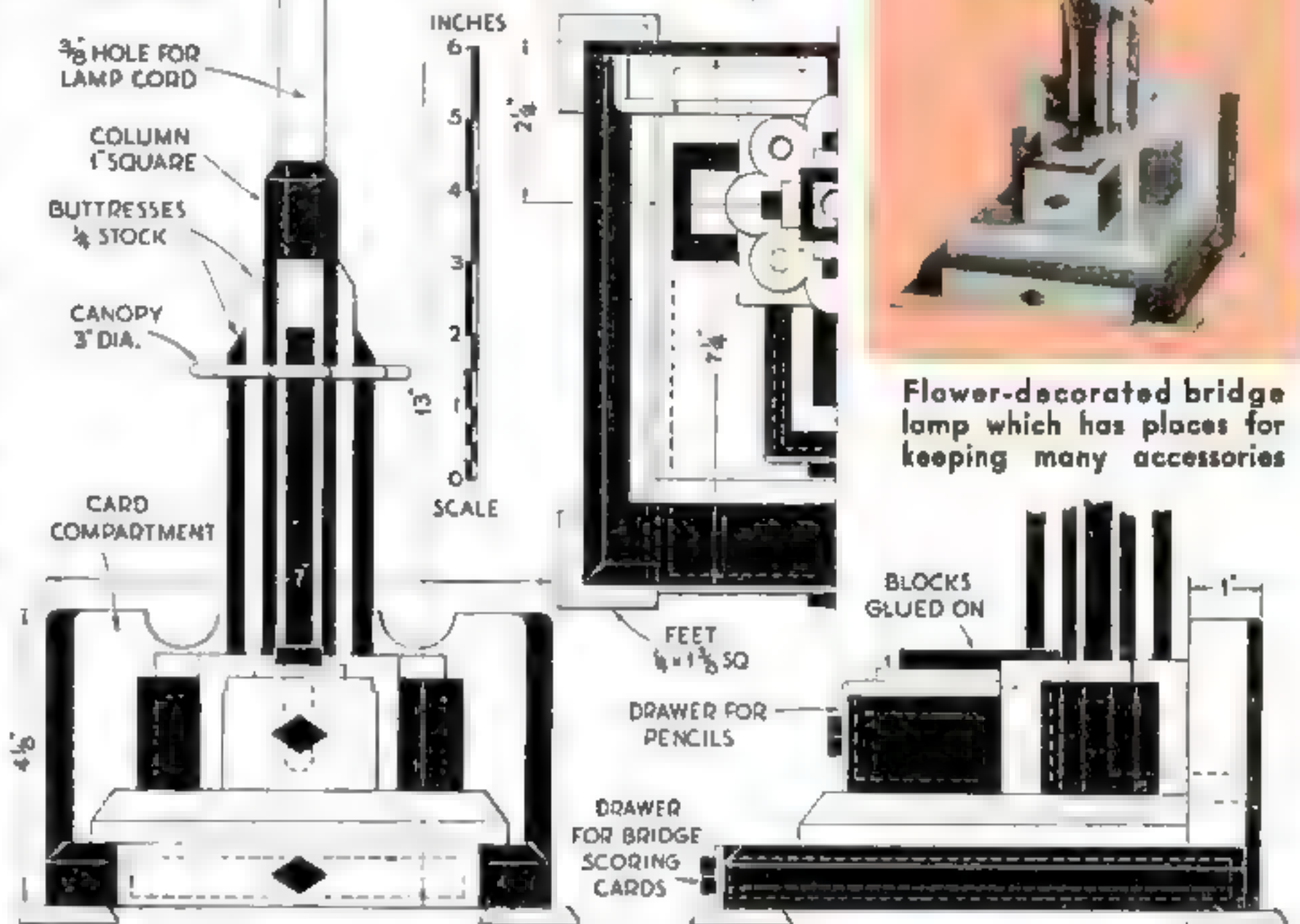
Unique Double-Duty Lamp to Use on Bridge Table

DECORATED in silver and black, this modernistic lamp contains a compartment at the back to hold playing cards, a flat drawer in the base for bridge scoring pads, a narrower drawer above for short bridge pencils, and a canopy around the column with four holes in which either cut flowers or long pencils may be inserted. The cost was about fifty cents exclusive of the electrical fittings.

The base is a $\frac{3}{8}$ -in. thick board, which is cut out for the drawer and rabbeted underneath so that a $\frac{1}{8}$ -in. plywood floor can be fitted in to support the drawer. On the base lies a second piece $\frac{3}{4}$ in. thick.

The column, which is glued in a hole cut $\frac{1}{2}$ in. deep into the base, is 1 in. square until within 3 in. of the top, when it is narrowed to $\frac{5}{8}$ in. square. The buttresses are of $\frac{1}{4}$ -in. stock, fitted all around as shown. On the back and two sides the buttresses extend to the base. The remainder of the lower construction is of $\frac{1}{4}$ -in. material.

The canopy is shaped from a piece $\frac{3}{16}$ in. thick and 3 in. in diameter. As it would be difficult to cut out the center to fit accurately around the buttresses, a 1-in. square hole can be made in it to fit over the main column; then the upper parts of the buttresses can be glued on separately, above the canopy. The drawers are made of $\frac{1}{8}$ -in. plywood.—WILLIAM FENTON.



Flower-decorated bridge lamp which has places for keeping many accessories

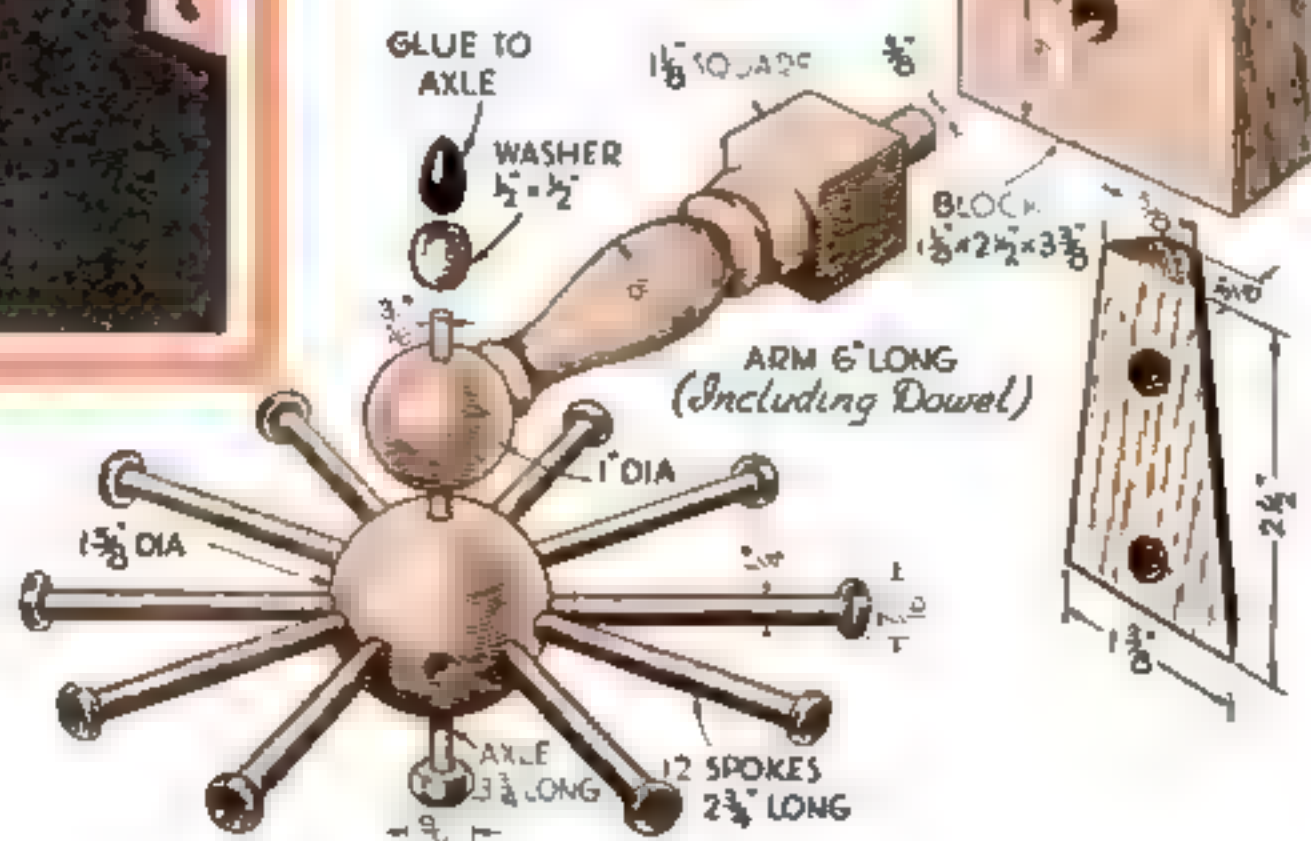
Revolving Rack for Neckties

BUILT in the form of a hub and spokes, this revolving necktie rack gained second prize for the Edmundston (N. B., Canada) Hobbyists in the Guild contest for three-hour projects. It is an ideal project for the wood-turning enthusiast.

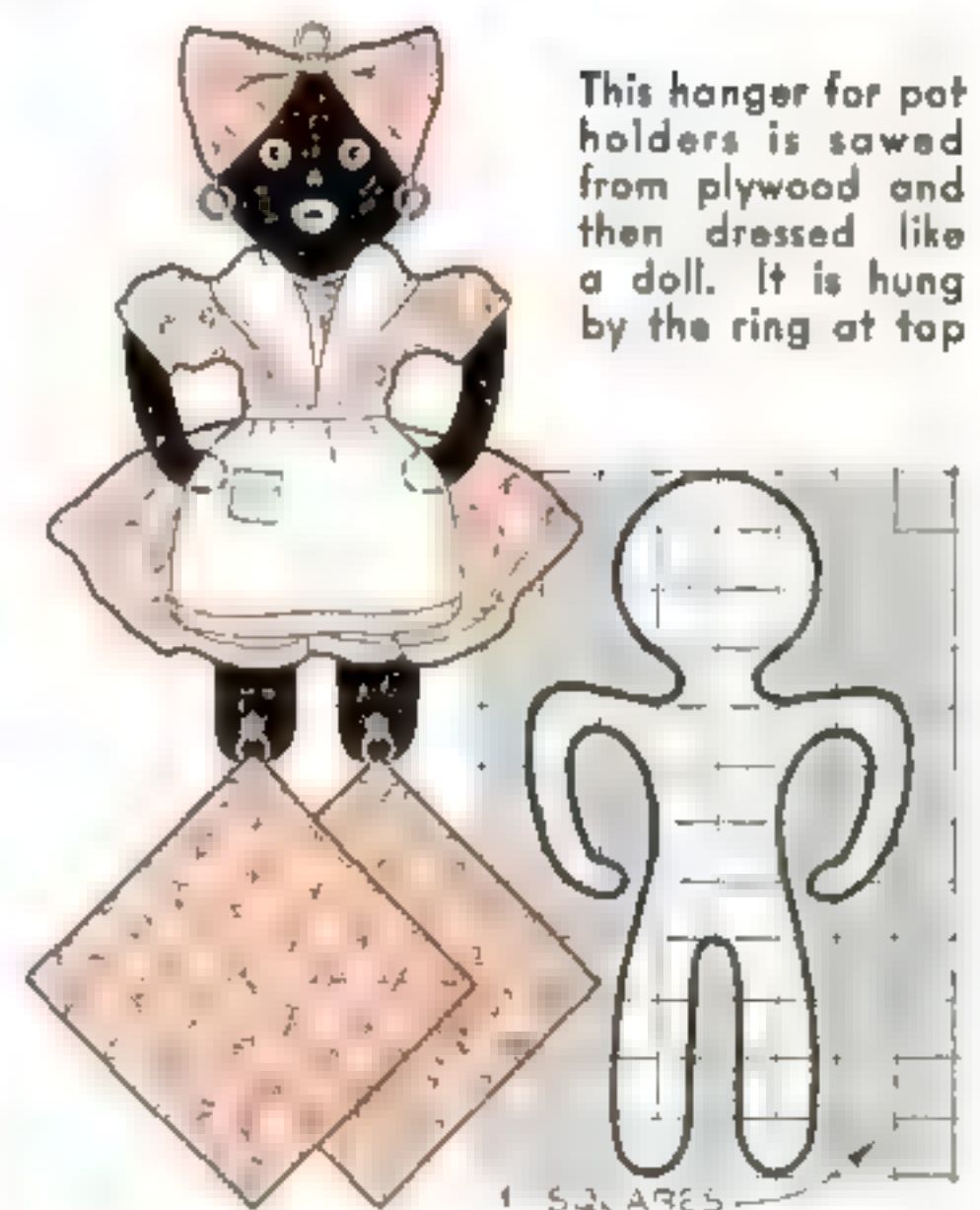
Maple, or any scraps of hardwood,

may be used. Turn the various parts in the lathe; and through the hub, end of arm, and small wooden ball, drill a hole slightly larger than the axle which fits through them. Also drill holes for the twelve spokes, and glue them in place. Slide the axle through hub, arm, and ball washer, and glue the conical tip on the end.

Cut a tapered dovetail slot in the back of the base as shown so that it can be fastened to the wall by sliding it onto a separate piece screwed to the wall. Drill a hole in the other side of the base to take the end of the arm, and glue together. Drive a nail through the base into the dowel.



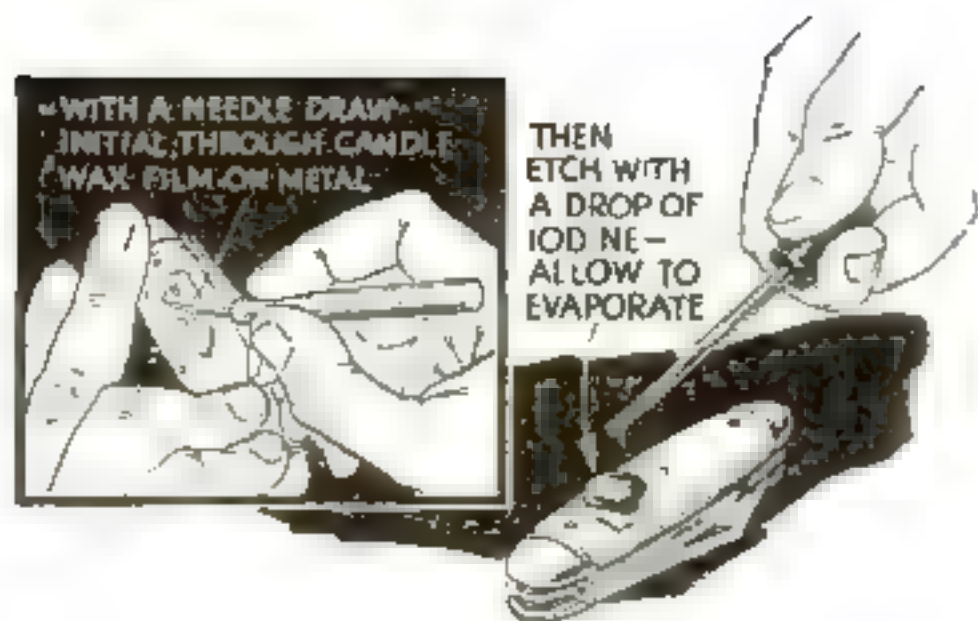
This tie rack, besides being an unusually interesting project for wood turners, has the advantage that it revolves so that one may quickly choose the desired tie. Dimensions and design may be varied to suit the constructor's taste



This hanger for pot holders is sawed from plywood and then dressed like a doll. It is hung by the ring at top

A Novel Way to Hang Pot Holders on Wall

HANGING on the kitchen wall, this novelty figure provides a handy place to keep pot holders. The body is cut from plywood, $\frac{3}{16}$ by 8 by 12 in. Paint it dull black and glue on the eyes, nose, and mouth, which are cut from paper or cloth. The dress and cap may be of flowered material, the collar and apron white. Two brass hooks are placed as shown for hanging the pot holders, and brass rings at the ears and at the top.—JOSEFA CLARK.

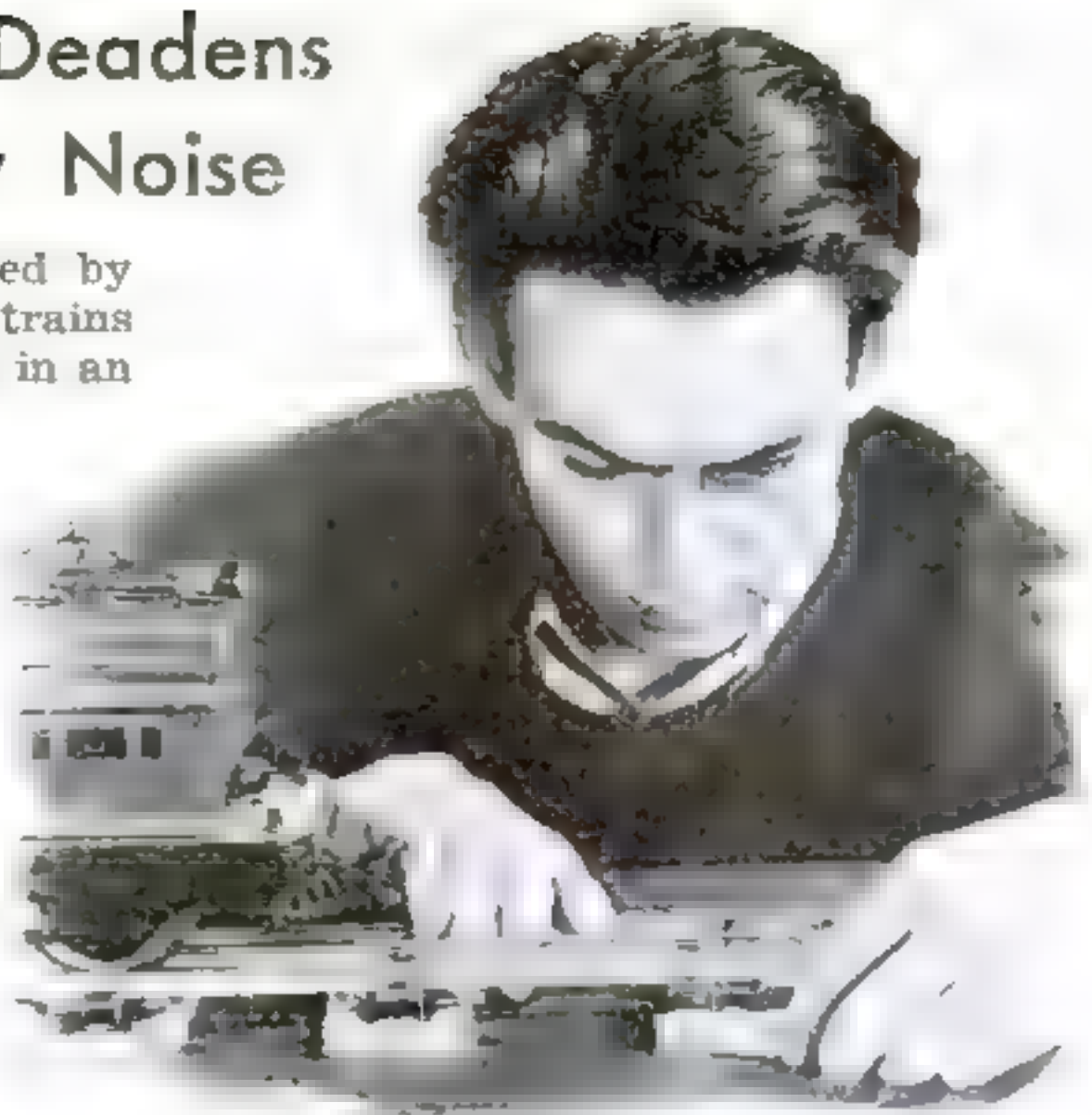


Iodine Used to Etch Initials in Metal

TO ETCH your initials on practically any metal, cover the metal with a thin film of candle wax and hold a match near the spot until the wax runs and becomes clear in appearance. When cold, draw the initials through the wax with a pin or needle. Apply a drop of tincture of iodine and allow it to evaporate. Then remove the wax.—R. W.

Sponge Rubber Deadens Model Railway Noise

THE noise and vibration caused by the operation of model railroad trains may become annoying, especially in an apartment house or a home where there are babies or small children whose sleeping periods must not be disturbed. In such cases, a simple expedient is to cut a number of small pieces of sponge rubber from an inexpensive kneeling pad and place them as shown under the ends of the ties. To hold the track in place, nails are driven through the ties as usual, but not far enough to press the ties down tightly. The nails are merely to keep the tracks from shifting out of line.—ROBERT W. BRIGGS.

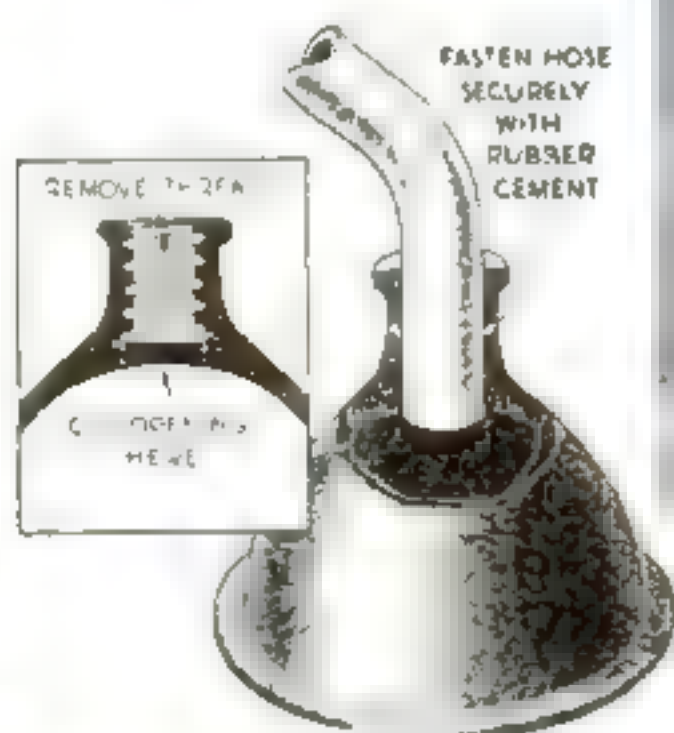


The ends of the ties rest on small sponge-rubber pieces

Clogged Drainpipe Cleared by Using Water Pressure

CLOGGED drains usually may be opened when other methods fail by using water pressure. A plumber's rubber force pump is removed from its handle, and a hole is cut through the handle socket. The threads in the socket are also cut out, leaving a smooth opening into which a short length of hose may be fastened securely with rubber cement.

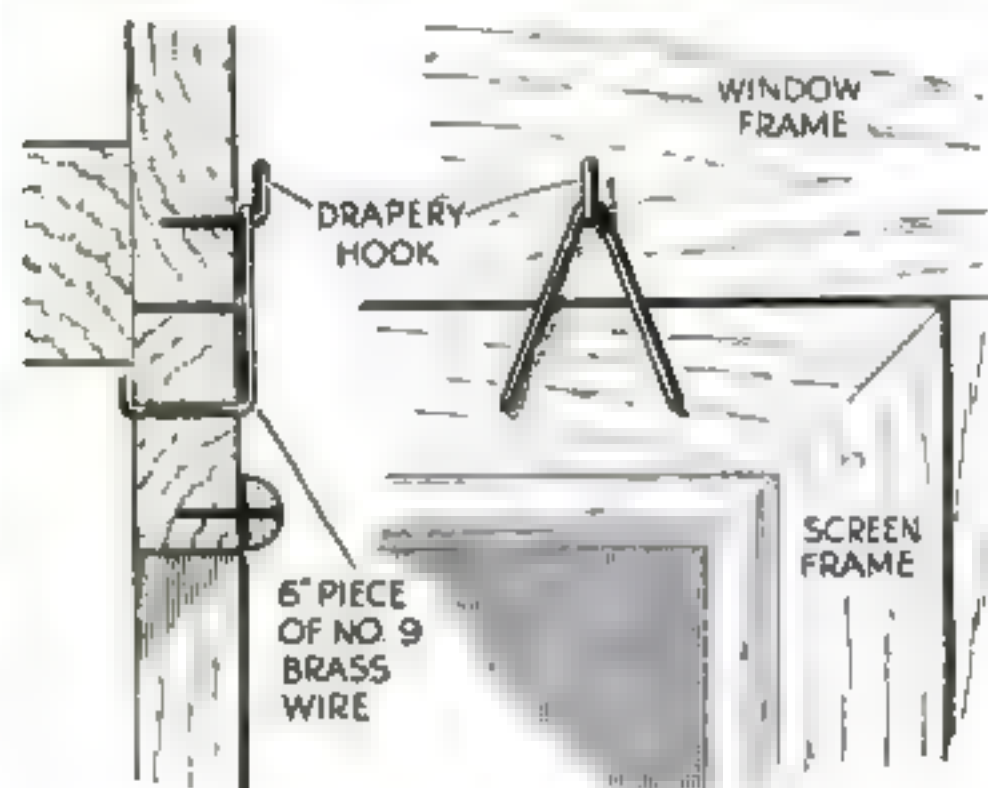
In use, the other end of the hose is slipped over a faucet while the cup is held firmly over the opening of the drain. Water pressure applied gradually by the method illustrated forces the obstruction out; then the faucet is turned on full and the trap thoroughly flushed for several minutes.—D. C. MARSHALL.



The rubber bell is held over the drain opening, and the water is turned on to force out anything in the pipe

Neat Screen Hangers Bent from Wire

HANGERS for full-length window screens may be made at trifling cost from 6-in. pieces of heavy brass or galvanized wire, bent as shown below. The legs are pushed through holes and cut off so that only about 1/4 in. protrudes; then the stubs are clinched.



Large Spike Serves as a Tiny Anvil

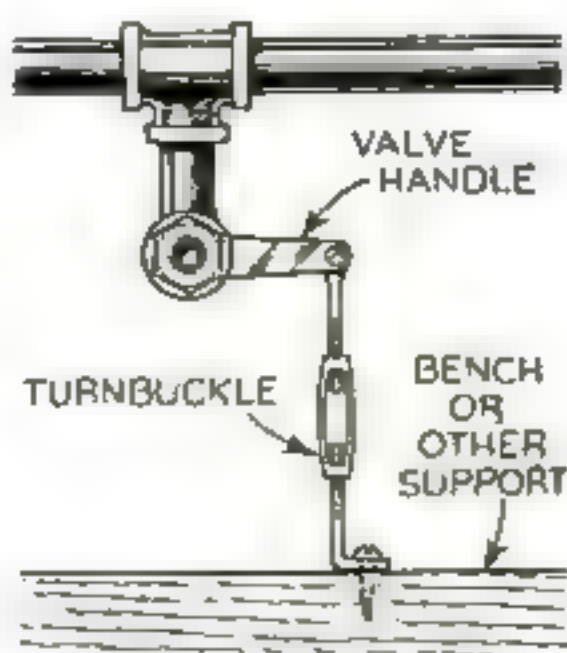
SET in a hole directly over a leg of your workbench, a railroad spike makes an excellent anvil for small work. Saw off the point of the spike, chisel a hole to a depth that will leave about 2 in. of the spike above the surface of the bench, and cut a hole in from the front of the leg so that another spike can be driven in to support the end of the vertical spike, as indicated in the drawing above.—EDWARD RAMAGE.



Shoe Polish Aids in Scribing Lines on Metal

SCRIBED lines or circles on metal can be made to show more clearly if the surface is first coated with liquid shoe polish applied with the regular dauber. This will dry almost immediately and adheres well enough to the metal to stand any handling it receives during the work. The polish is easily removed afterwards.—K. M.

Turnbuckle Adjusts Valve with Great Accuracy



IN ONE laboratory the flow of air or water is regulated to insure a constant small flow when necessary by using a turnbuckle as shown. One of the rods is attached to the bench, and the other rod to the valve handle, giving a vernier-like adjustment.



Scribing a circle on sheet metal which has been coated with shoe polish so the line will show clearly when scratched through

Fruit Novelties

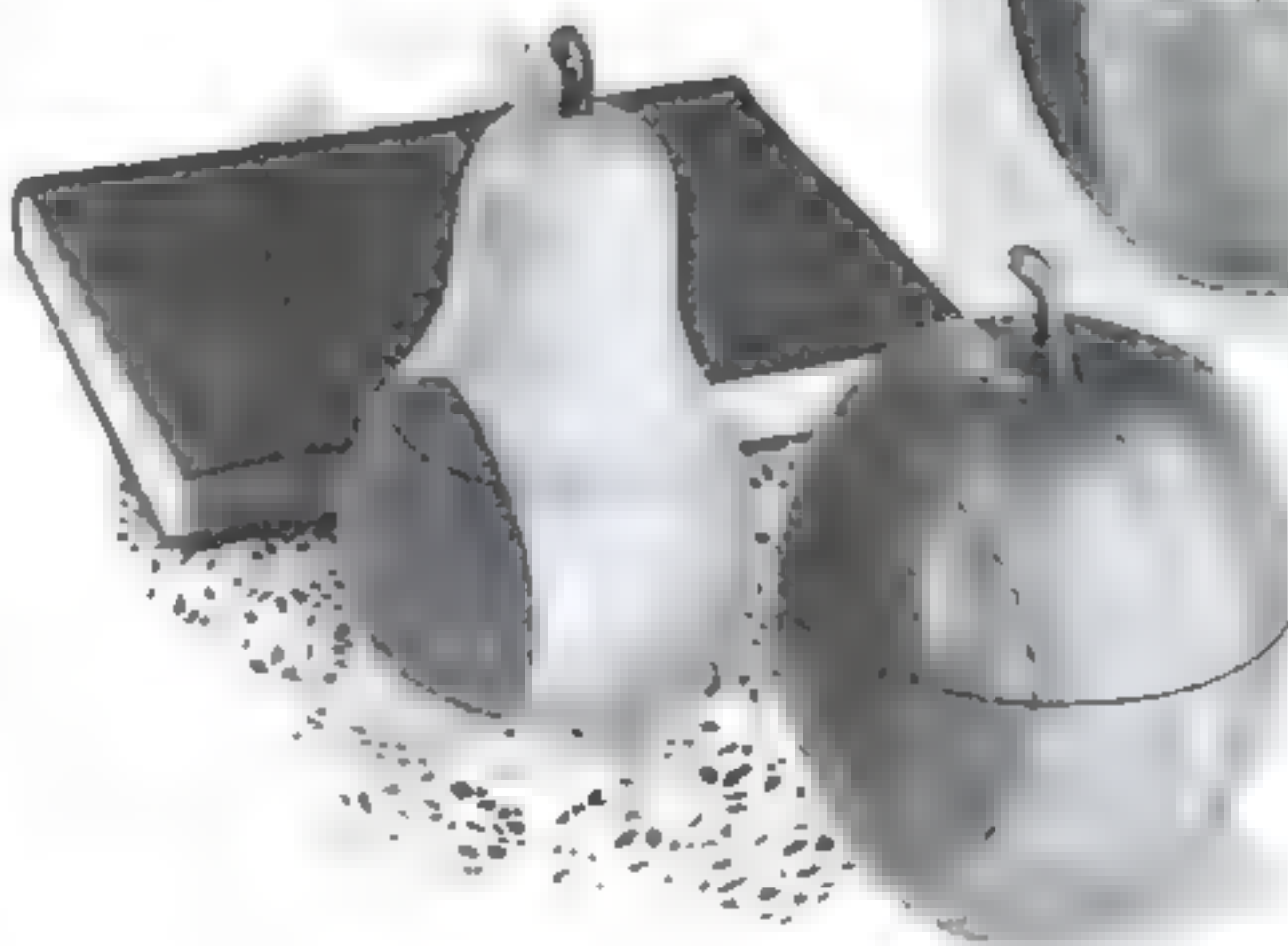
TURNED FROM WOOD

By Howard R. Heydorf

SMALL pieces of wood of various kinds and colors may be used for turning beautiful cigarette containers or trinket boxes in the shape of fruit, such as the apple and pear illustrated.

Making pieces of this type will teach the beginner in wood turning more than hours of ordinary practice, although he should, of course, be familiar with the uses of the various cutting tools and know how to operate the lathe properly.

Choose the woods to match as closely as possible the colors of the ripe fruit. Redwood, cherry, mahogany, rosewood, and various kinds of cedar may be glued together for a red apple. Poplar or any other yellow woods will serve for the yellow parts of the pear. Glue the wood to form one piece 2 or 3 in. longer than the finished article, using a good grade of waterproof casein glue. Different thicknesses of wood should be used to prevent too much regularity or



The apple, of natural size, holds cigarettes. The pear is for use as a trinket box.

uniformity of colors in the completed work.

When the glue is dry, the ends of the block are squared up, and the block is cut into two parts. Unless the operator is experienced, he had best make a sectional drawing of the article and cut inside and outside templates.

Either end of the fruit may be turned

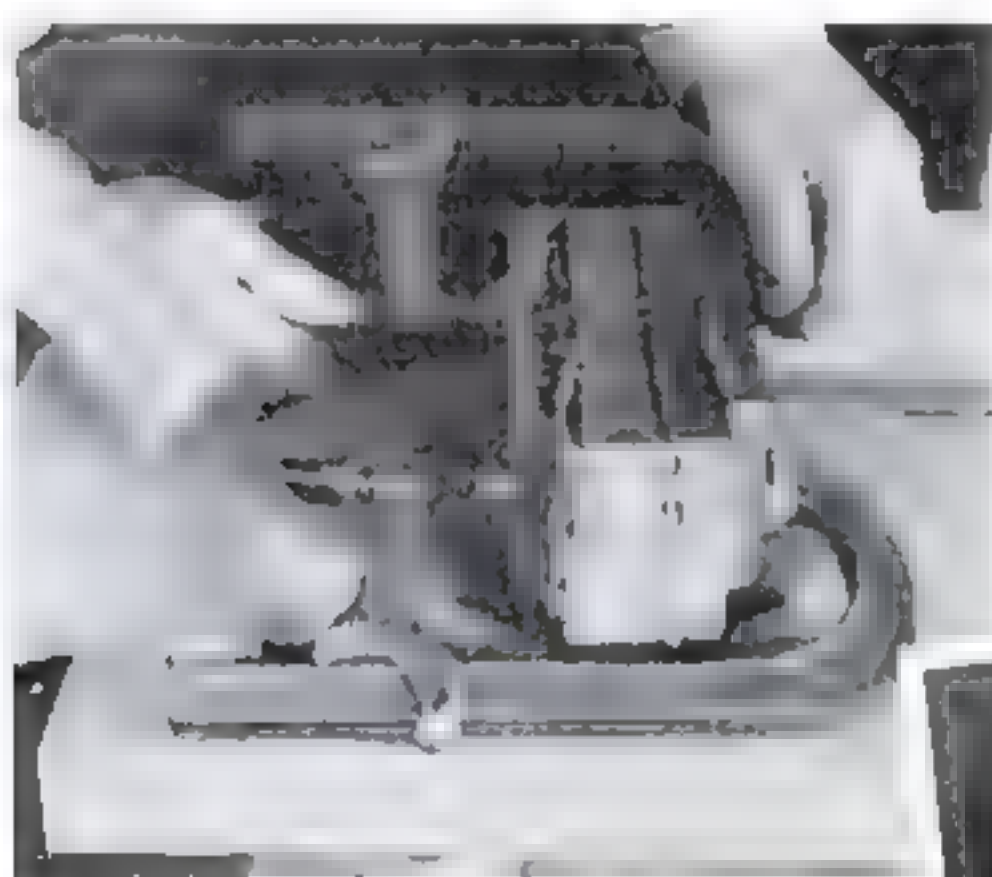
In rough boring the block with an expansion bit, the lathe must turn very slowly

The bore is turned to the shape of the template, and half of the joint is formed. It is best to turn the outside of the block smooth. The other block is treated in a like manner, and the opposite joint is cut to a friction fit.

The pieces are now fitted together to form the solid block. The tailstock is used, and the whole block is turned to shape, the outside templates serving as a guide. The parts may be separated occasionally and the thickness of the shell tested.

A dark brown wood such as black walnut can be shaped and sanded to form the stem. It fits into a hole bored in the top of the turning.

A waxed or a varnished finish is preferred by the writer.



The layers must be securely clamped. After the glue is dry, the ends are squared and the centers cross-marked.



The bored-out turnings. The second block to be turned is left on the faceplate, and the other piece added for finishing.



Completing the apple. The two segments are fitted so that the woods match; then any irregularity will not show.



The joint must be turned with painstaking accuracy and sanded to a snug friction fit with the part first turned.

Using Two Flash Bulbs for Portrait Photos

THE notion that it is difficult to take good portraits by means of flash bulbs comes from the fact that most flash-light pictures are made with a single light flashed straight into the face of the sitter. By using one light above and to the side of the sitter, and a reflector at the other side to lighten the shadows, or by using two lights, with the second light at the camera position, fine portraits may be taken. Because of the instantaneous brilliance of the flash light, natural expressions may be caught with even an inexpensive box camera.

Any flash-bulb holder, operated by batteries, may be easily adapted to fire a second bulb in a remote reflector. All that is needed is a piece of double cord, a small convenience outlet, and a nut and screw. The method of mounting and wiring is illustrated. The nut is soldered inside the bottom cap of the flash-light holder over a hole drilled in the cap. This nut takes the screw through the center of the outlet, holding the outlet securely yet permitting it to be removed at will.



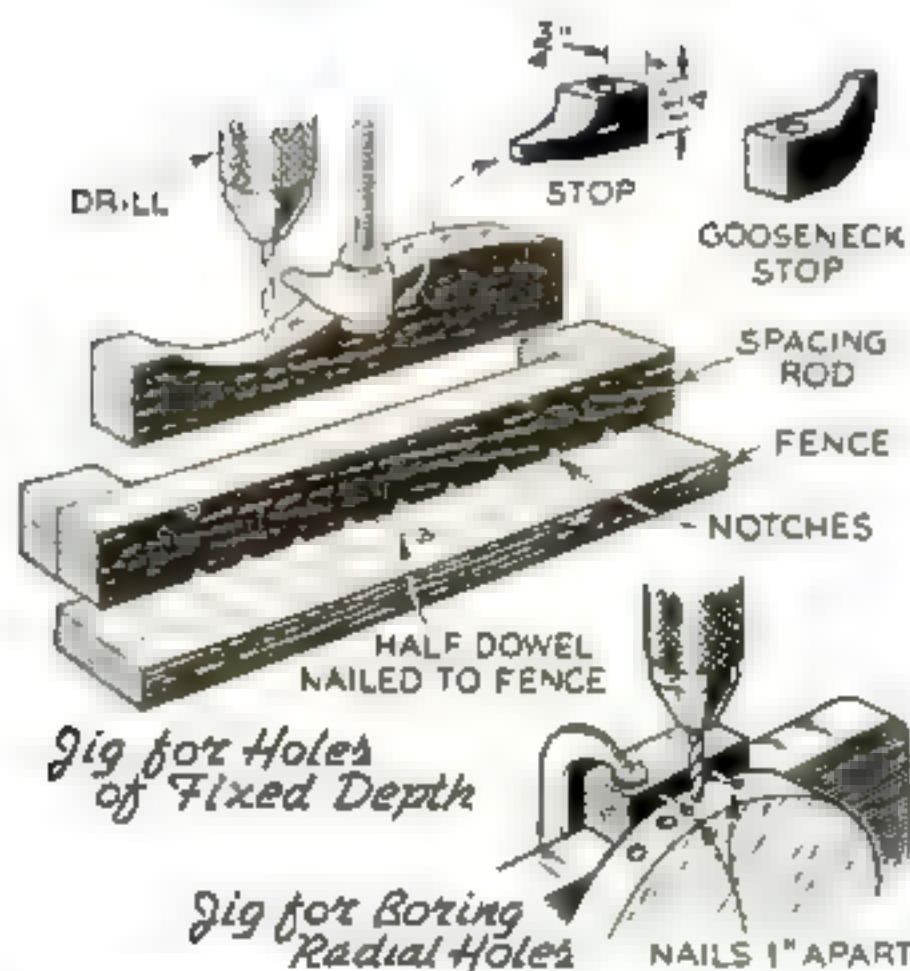
The exact means of connecting the outlet to the socket will depend upon the construction of the flash-light box, but the end of one wire should be secured (preferably with solder) to the middle contact of the socket, and the end of the other to the brass inner

shell. The wires should be arranged that they will not short-circuit anything.

To fire the second bulb in a distant fixture, merely insert the plug from the fixture into the new outlet and press the regular button.—K. M. S.



Jigs Aid in Boring Awkward Work



THREE ingenious jigs for difficult wood-boring jobs are illustrated. One is a stop to enable a series of holes to be bored to a definite depth in an irregular surface, as, for instance, when a number of parallel rods have to be fixed in a band-sawed edge in such a way that the upper ends of the rods will reproduce the same curve.

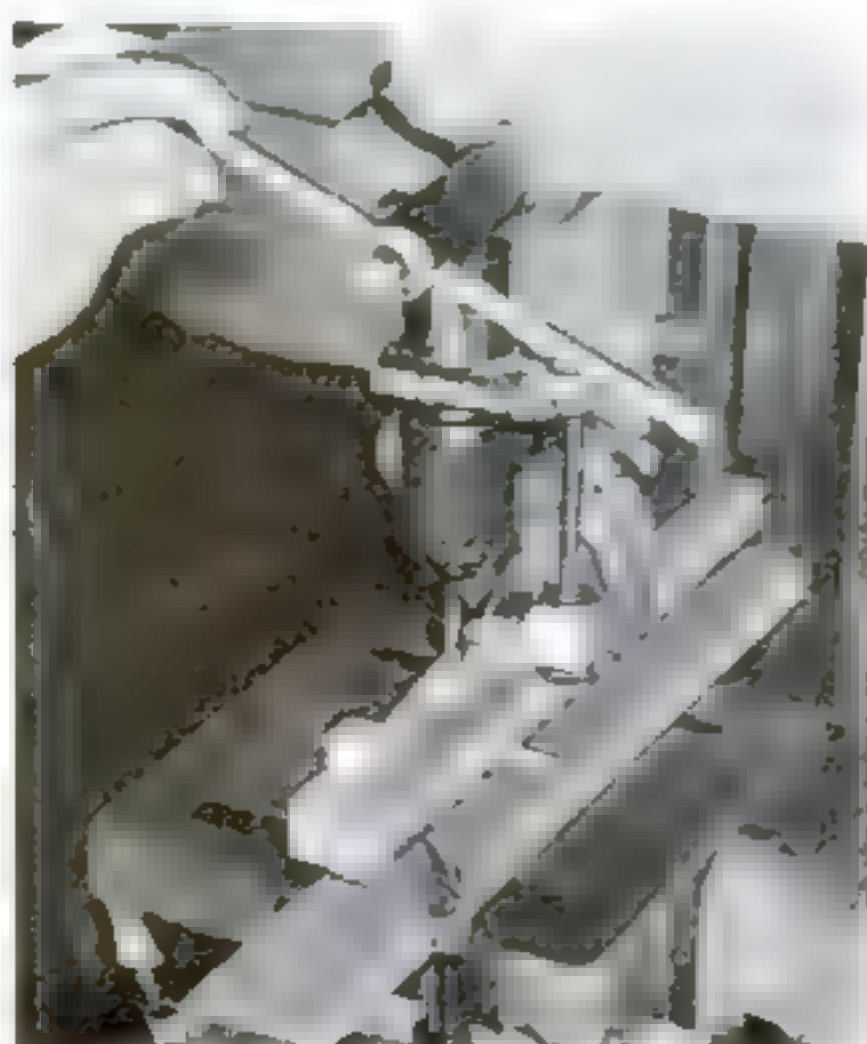
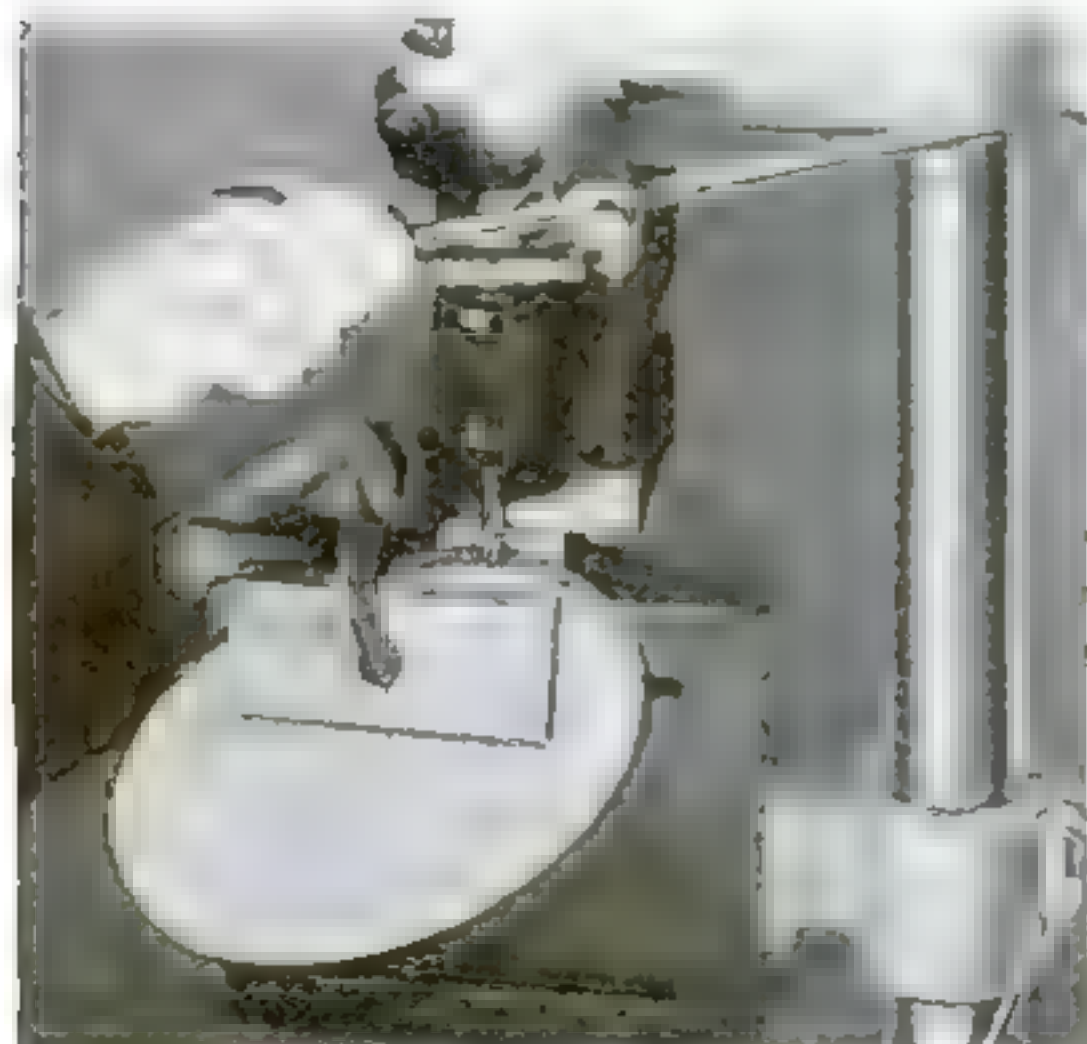
Another aid is an automatic spacing device, which makes use of a notched spacing rod. The third is a jig for boring equally spaced radial holes in the edge of elliptical pieces. The holes are spaced by wrapping a strip of paper around the edge and dividing it when flattened out. Clamp the work to touch both nails.—E. L.



Bottle Converted into Handy Spot Remover

FOR removing stains from clothes, woodwork, and other articles, and for special purposes such as cleaning splatters of road tar from automobiles, a so-called "spotter" may be made from a small bottle with a metal screw cap.

Drill several small holes through the cap, place a wad of clean cotton or waste on top, and bind on a thin chamois-skin cover. Fill the bottle partly with the desired cleanser, which may be carbon tetrachloride, naphtha, (very inflammable), alcohol, or other chemicals. When the bottle is inverted, the cotton and chamois become thoroughly saturated.—ROLLIN H. WAMPLER.





Good STEERING GEAR

will help you win SAILING-CANOE RACES

IN A SAILING canoe, especially if used for racing, the rudder is of the utmost importance. It must be strong, stiff, easily controlled, and as thin as practicable.

A metal trip-blade rudder fitted with a Norwegian tiller meets these requirements. The metal may be brass, sheet steel, sheet iron, or if expense is no object, duralumin. A blade 6 in. wide and 18 in. long from tip to pivot is ample for an 18-ft. canoe; 5 by 16 in.

By JACK HAZZARD

for a 16- or 17-ft. canoe; 6 or 7 by 20 or 22 in. for a 20-ft. canoe.

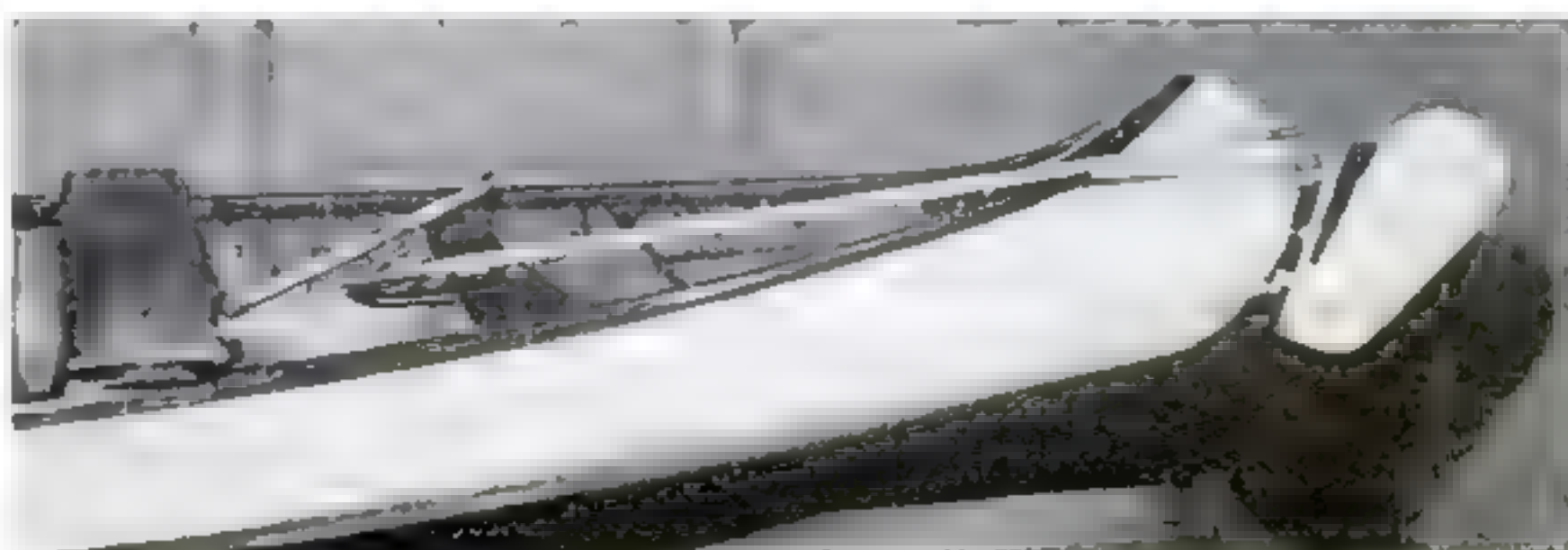
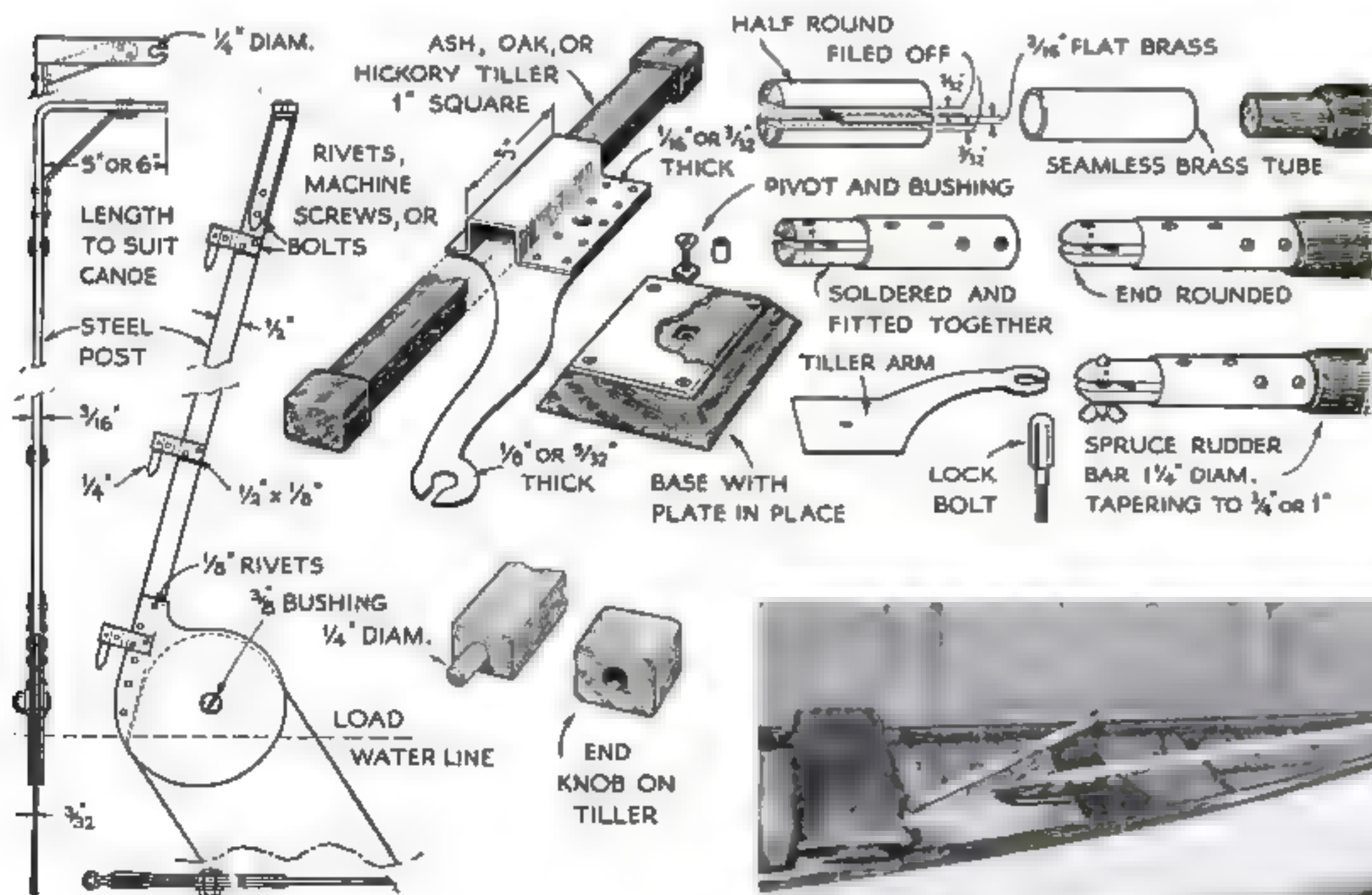
Constructional details are given in the drawings. The working of the coupling, however, may require a word of explanation. The slot in the rudder arm is just wide enough ($9/64$ in.) to enable the threaded portion of the lock bolt to pass through, while the hole

drilled in the arm is a close fit for the $1/4$ -in. part of the bolt. The bolt can be moved freely up and down in the coupling, but cannot turn because of the steel pin. By unscrewing the wing nut, the bolt can be shoved up so as to present the threaded portion to the slot for easy removal, but once it is tightened, the coupling cannot be unshipped.

The rudder bar and tiller should be sanded, given a coat of shellac, finished with high-grade marine varnish, and polished with automobile wax. All steel parts should be cleaned, given two coats of metal primer, well rubbed down, then enameled to match the canoe.

For those who are willing to do without the drop-leaf feature, a much simpler rudder may be made as shown in the drawings marked "alternative design." The blade is inserted in a saw cut in the rudder post. The *(Continued on page 112)*

Left, details. Below, assembly. About 14 in. is enough clearance between the gear and sliding seat



SIMPLIFIED MODEL OF A TRIM-LOOKING

'President' Liner

DURING the World War the United States Government started to build a number of large transports, some of which were finished as intermediate passenger liners. These were named after various presidents and came to be known as "president liners." There are two types, almost alike in appearance, and the larger of the two is the subject of this new Model-of-the-Month Club project.

The model is the *President Lincoln* of the Dollar Line. The *Cleveland*, *Taft*, *Pierce*, and *Wilson* are similar in funnel markings, color scheme, and general appearance. The American Oriental Line also uses five in its service to the Far East. On the Atlantic, two vessels

are used by the United States Lines, and at one time four of them flew the Munson Line flag on the South American run.

Built on a scale of approximately 1 in. equals 40 ft. of the real ship, the model is 14 3/4 in. long. It is a water-line model, but for the benefit of readers who may wish to include the whole hull, the underwater part has been

shown in dotted lines on the drawings.

Any clear, fine-grained softwood may be used, but white pine or basswood is recommended and is, indeed, preferable to the much softer balsa wood for a model of this type. Cut all the wood and fiber to the sizes specified in the list at the end of the article.

Sandpaper *C* so that it tapers gradually from its full thickness to a sharp edge. Firmly glue *C* to *B*, *E* to *D*, and *D* to *B* and *C*. Fasten *A* lightly to *B* as it must be removed later for painting. On the block thus formed trace the shape of *D* and cut away the excess wood. On the underside, trace and cut the shape of *A*. However, preserve the shape of *D* as first cut, and a flared bow and cruiser stern will result. Detach *A* from *B*, after smoothing the unit with fine sandpaper.

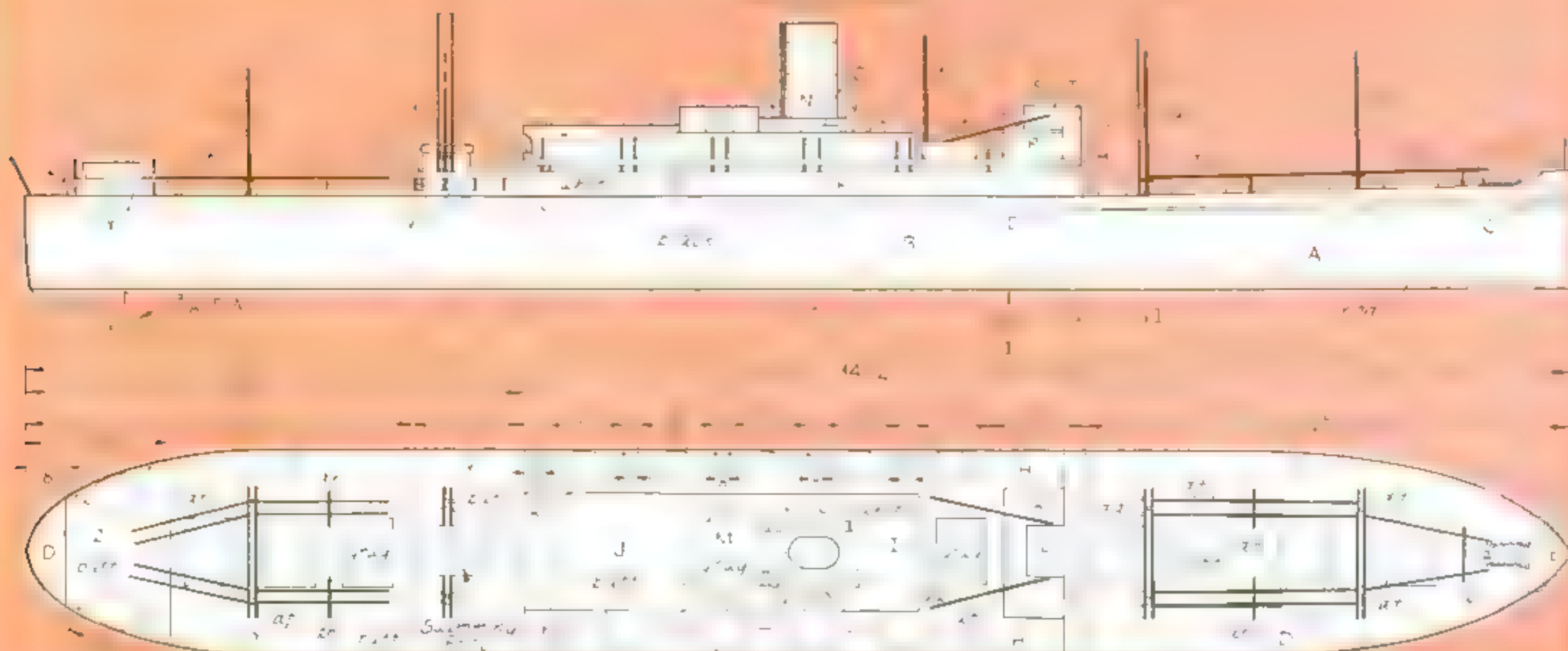
The drawings show how the superstructure units are assembled. Note that pieces *J*, *K*, and *L* form a veranda overlooking the swimming pool. Drill holes for the davits along edges of *H* and *Z*. Insert short wires into the holes and push into *F*. Cut off tops so that only 1/4 in. of the wire protrudes above *H*.

Make twelve lifeboats from the 1/4 by 3/8-in. stock. Sandpaper the corners of the stick to shape, mark 1/8-in. spaces along its length, and cut crosswise, as if slicing bread. Glue to the positions indicated between davits.

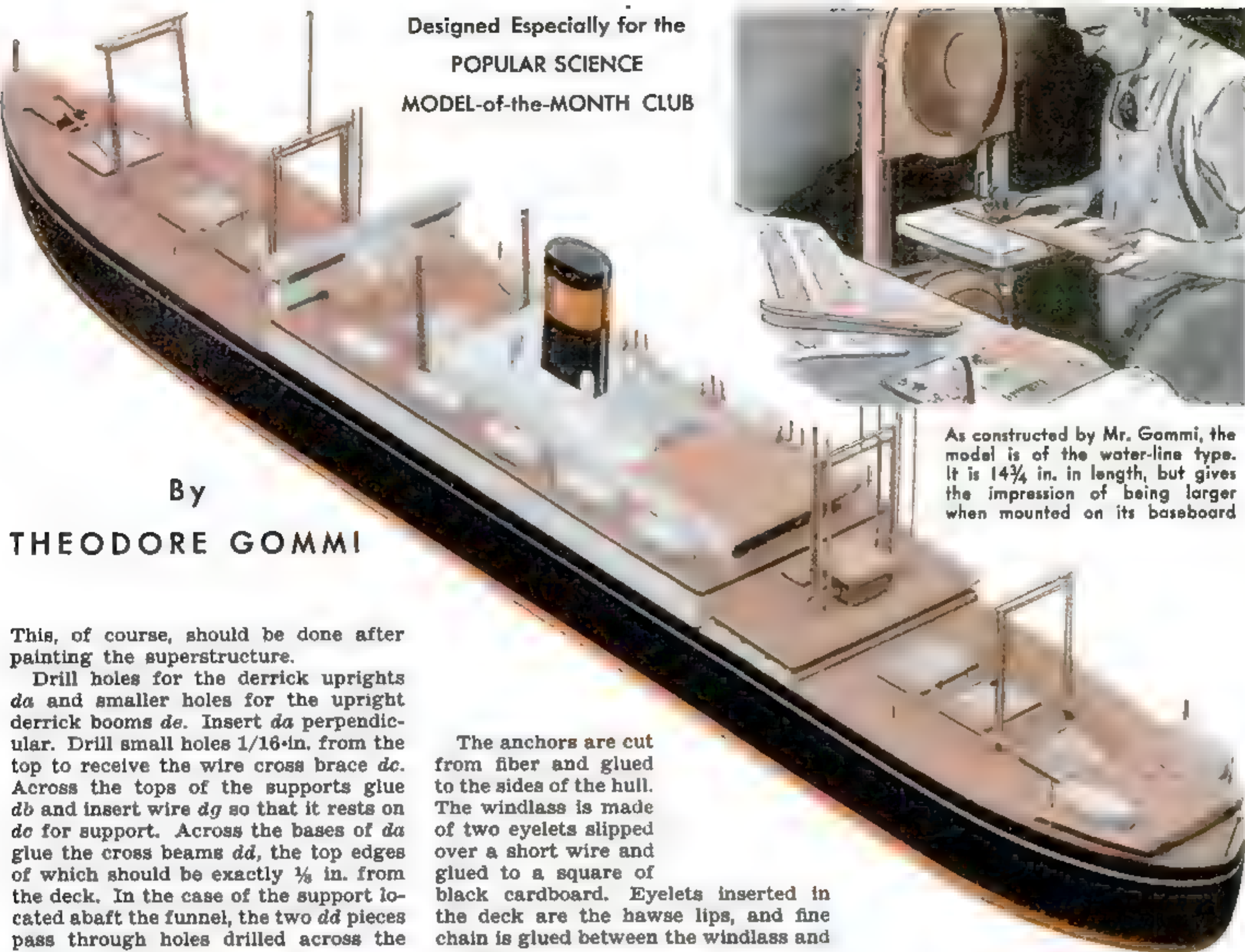
Cross section *V* shows how the bridge is built up. *R* is glued at each end for support. A realistic effect is obtained by covering the space between *R* and *T* with paper on which heavy black lines about 1/16 in. apart have been drawn.



Model of the "President Lincoln," one view showing arrangement of derricks. Drawings are given below and on the opposite page



Designed Especially for the
POPULAR SCIENCE
MODEL-of-the-MONTH CLUB



By
THEODORE GOMMI

This, of course, should be done after painting the superstructure.

Drill holes for the derrick uprights *da* and smaller holes for the upright derrick booms *de*. Insert *da* perpendicular. Drill small holes $1/16$ -in. from the top to receive the wire cross brace *dc*. Across the tops of the supports glue *db* and insert wire *dg* so that it rests on *dc* for support. Across the bases of *da* glue the cross beams *dd*, the top edges of which should be exactly $1/8$ in. from the deck. In the case of the support located abaft the funnel, the two *dd* pieces pass through holes drilled across the swimming pool.

The upright derrick booms are inserted in their holes so they just touch *dd* and *db*. The other booms are laid between *dd* and the bent wire supports *dh*.

The smaller derricks between the funnel and the bridge are of the usual type. All the parts are glued together.

The anchors are cut from fiber and glued to the sides of the hull. The windlass is made of two eyelets slipped over a short wire and glued to a square of black cardboard. Eyelets inserted in the deck are the hawse lips, and fine chain is glued between the windlass and the lips.

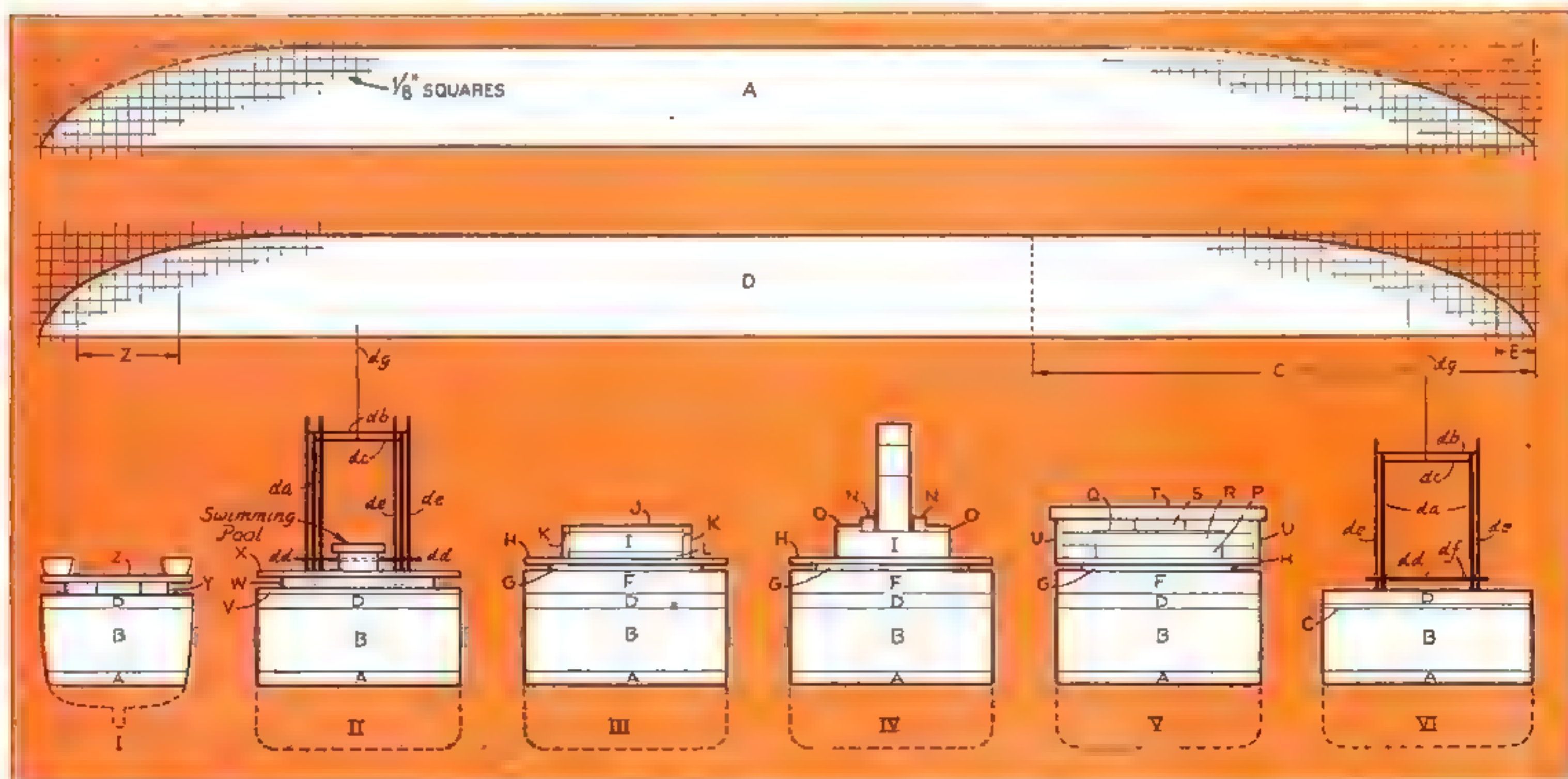
Paint the various units before assembly. The hull sides are black, except for piece *A*, which is red. The decks are buff, and the entire superstructure is white. The plan indicates any exceptions to this rule. After the paint is dry, *A* is glued to *B*.

The funnel is black with a red band.

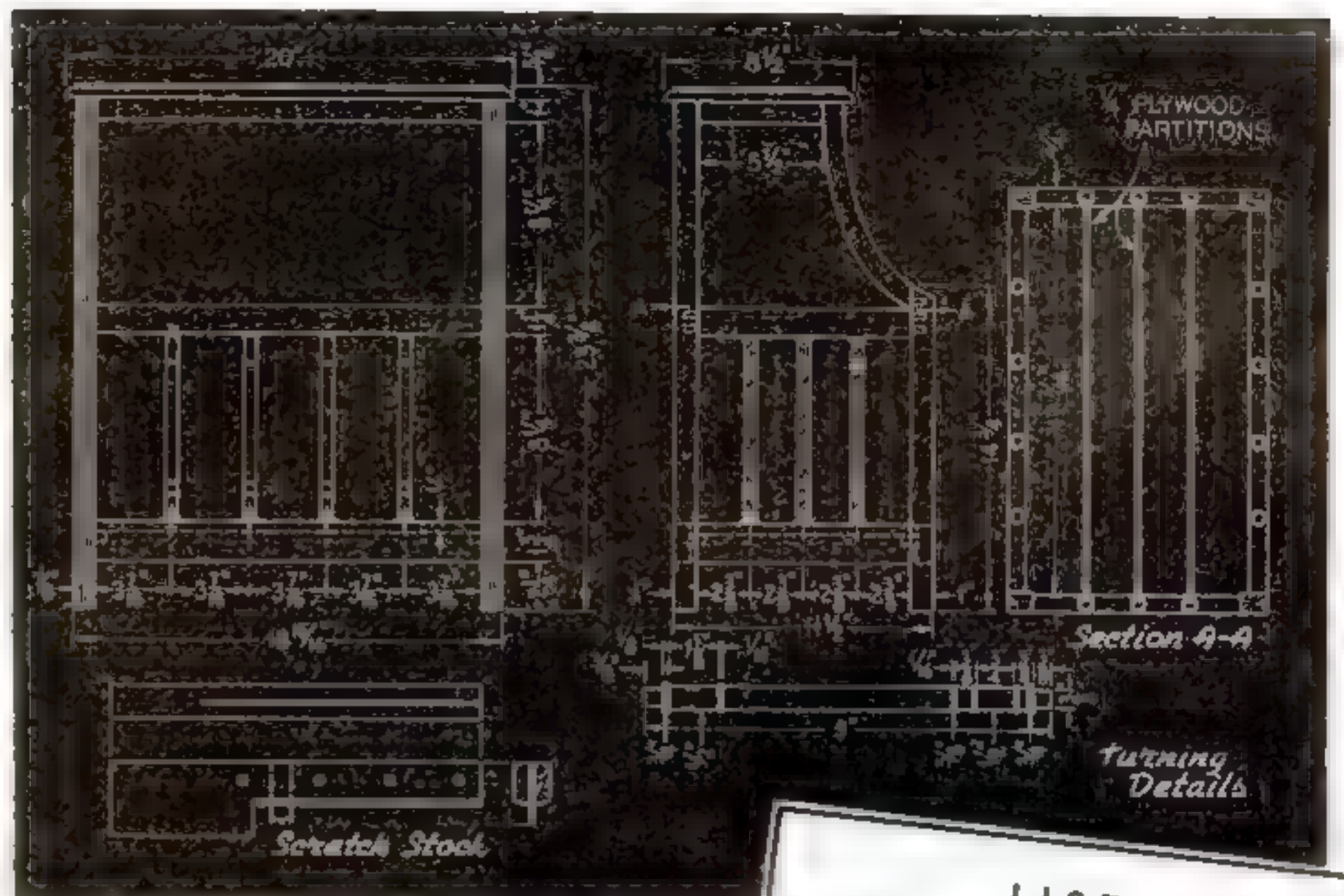
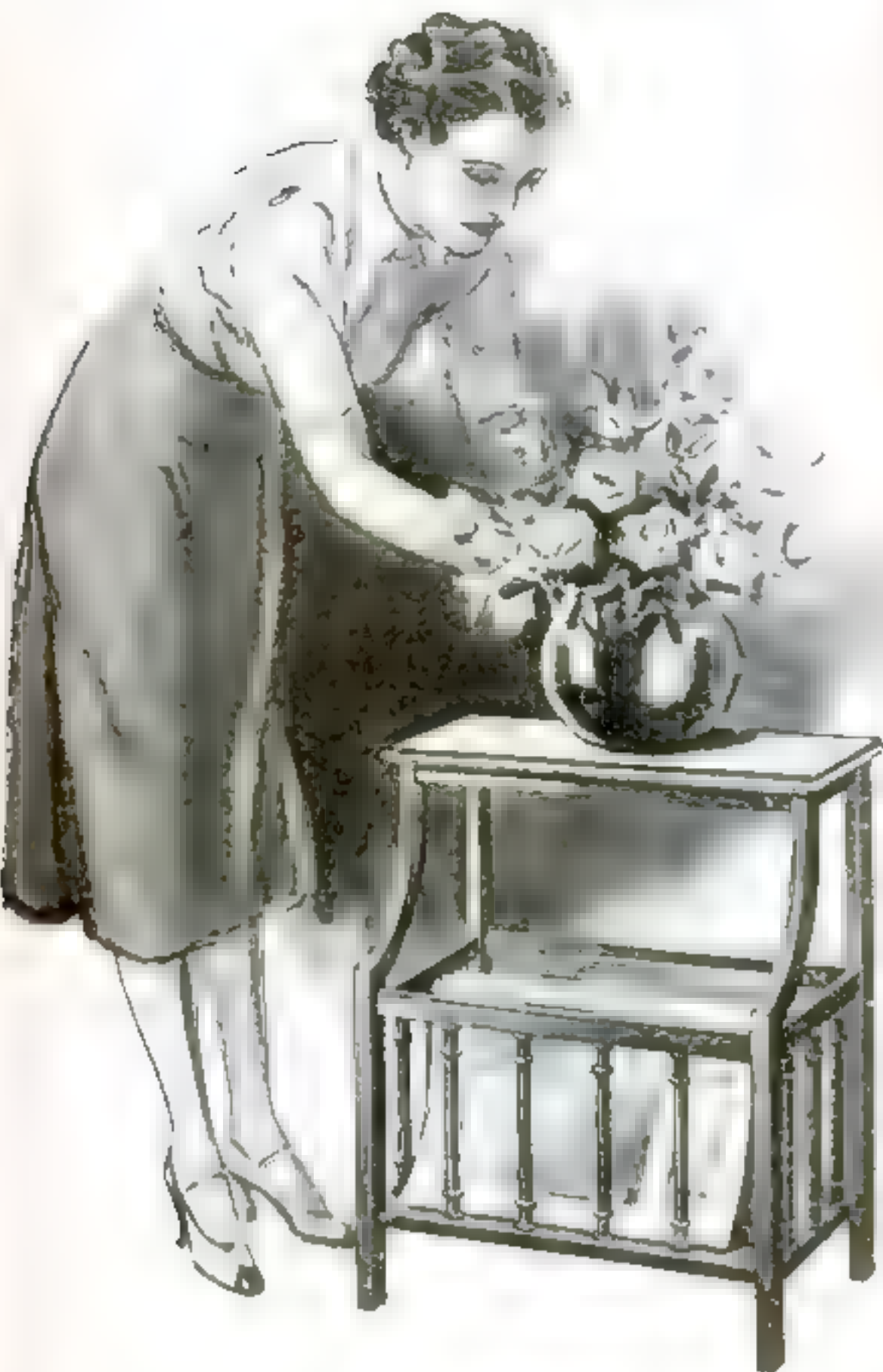
As constructed by Mr. Gommi, the model is of the water-line type. It is $14\frac{3}{4}$ in. in length, but gives the impression of being larger when mounted on its baseboard

It is best to paste on a thin red paper strip, previously marked with a \$ sign. The hatches are gray, and should be fastened to the deck before the derrick supports are erected. The inside of the ventilator cowls is red.

A thin yel- (Continued on page 112)



Small Magazine-Holding End Table



Made from a good cabinet wood, this forms a decorative piece. A scratch stock is used to reed the front legs

By HERMAN
HJORTH

TWO of the most indispensable pieces of furniture in the modern home, the magazine "basket" and the end table, are combined in this attractive piece. It should be made from a close-grained cabinet wood such as mahogany, walnut, birch, or gum.

Begin by turning the fourteen spindles. Six of these are grooved for the plywood partitions, and it is best to cut the grooves on the circular saw while the stock is square.

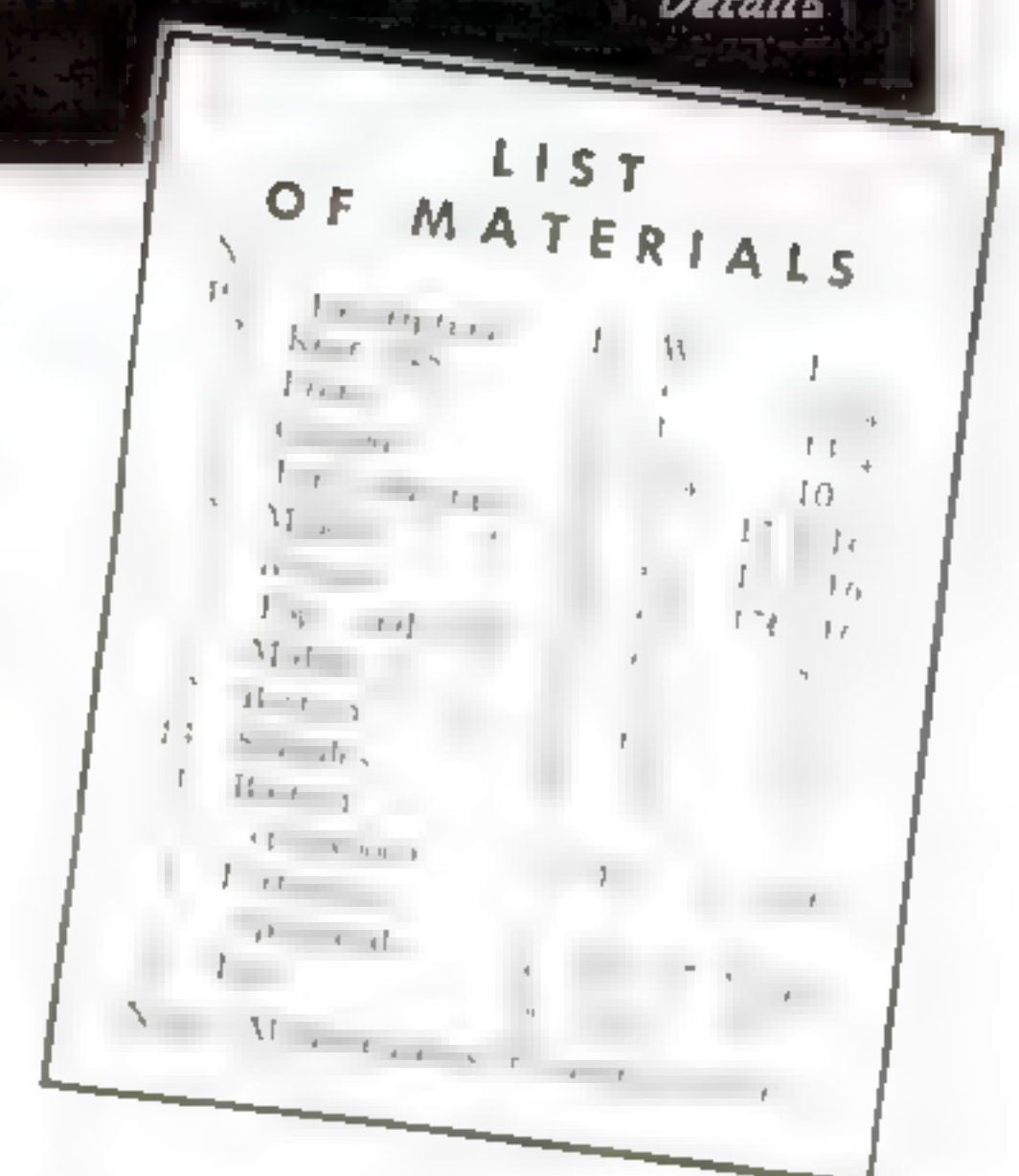
The legs and rails are then sawed and planed to dimensions. It is preferable to fit and glue the two ends first.

When these are dry, the bottom and partitions are fitted. The bottom is supported and fastened to cleats on the inside of the lower rails. When all these parts are ready, the sides are assembled and glued.

Reeding the front legs as shown adds considerably to the appearance of the piece. Reeding is very simply done with an easily made scratch stock. The cutter may be ground from a discarded hack-saw blade or similar piece of steel.

The top is fastened with screws from the underside of the top rails. Its edge may be shaped as shown, or it may be reeded to correspond to the front legs.

After being stained, the piece may be



finished with two coats of thin shellac, each rubbed down with No. 3/0 steel wool. The spindles, however, should be French polished while in the lathe, which should run at its slowest speed.

How to Make Odd-Sized Sink Drain Boards

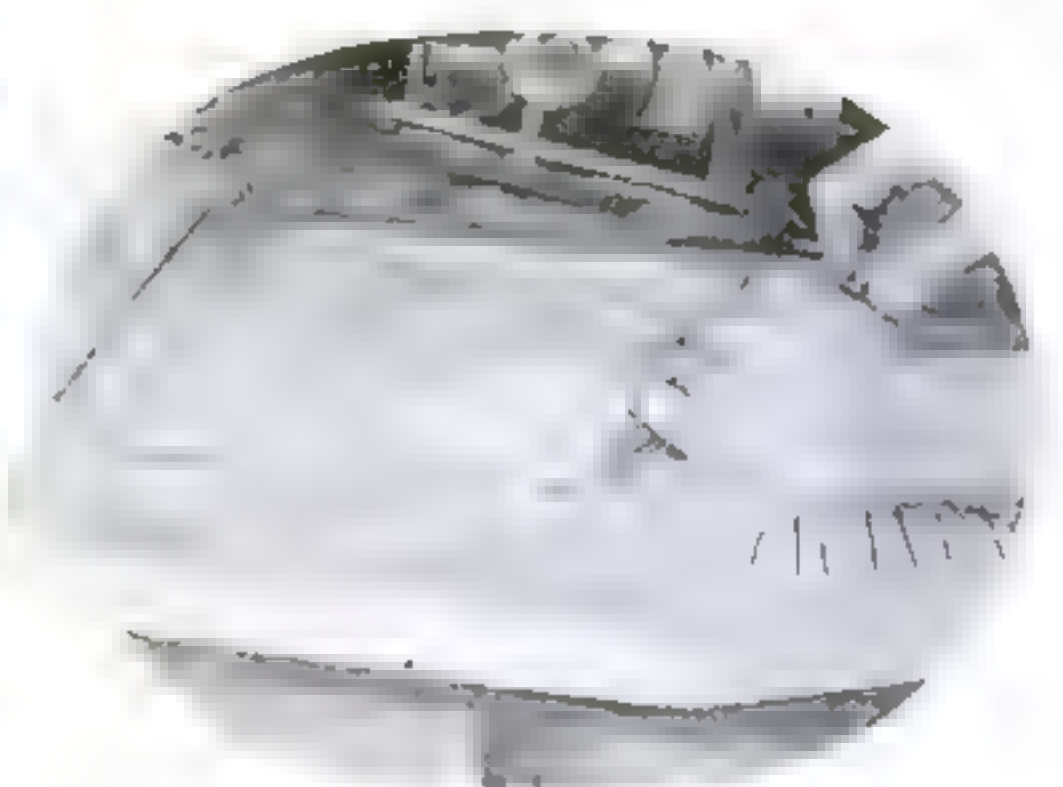
KITCHEN sinks are sometimes so placed, particularly in old houses, that there is no room for a porcelain drain board. In such cases a smaller board may be made from clear white pine at least $1\frac{1}{4}$ in. thick, doweled and glued to the required width with waterproof casein glue. Grooves are about $\frac{1}{4}$ in. deep.

In finishing, avoid shellac as an undercoat. Build up the surface with four or five coats of high-grade enamel. The board is supported by a large shelf bracket from the wall and is fastened to the sink with a strap-brass clip as shown. R. O. L.



Wooden drain board, enameled green. The stock is a full $1\frac{1}{4}$ in. thick. The center was saw kerfed in both directions, the waste wood removed with gouge and chisel, and a block plane used for the finishing

The board is fastened to sink as at right, and supported by a shelf bracket on wall



MAKING MOCCASINS

THAT REALLY FIT

By Maurice H. Decker

Camping Editor of "Outdoor Life"

THIS Objibwa type, two-piece moccasin fits like a shoe and is splendid for still hunting and hiking, for camp use, for canoeing and yachting, and to wear as a house slipper.

Materials: 1 pc. heavy oil-tan leather 12 by 22 in., 3 yd. $\frac{1}{8}$ -in. lacing, and 1 pair $\frac{3}{16}$ -in. thongs for ties. The cost is from \$1.25 to \$1.50. Any dealer in leather can supply regular moccasin stock and laces.

Lay off the toe and bottom patterns on cardboard, cut to shape, and punch out the holes. To obtain a right and a left for each piece, merely turn the templates over. Cut the leather with a sharp knife, pressing hard enough to cut clear through the first time.

Punch the lace holes with a leather punch, or if you want tight seams, use a tenpenny nail. These holes must be opened up with an ice pick when you lace, but as the moccasin dries, the leather shrinks tightly about the laces and makes the shoe watertight. Note that the lace holes in the bottom of the moccasin are spaced almost twice as far apart as the holes in the toe. You must pucker or "full" the bottom piece between each stitch by pulling on the lace until each pair of holes are drawn opposite and even.

Bevel or skive off the edge of each bottom around the toe on the wrong side or inside. The smooth side of the leather is the right side and the outside. Soak the bottoms in water until thoroughly softened, but do not soak the toe pieces.

Count off holes on either side and begin to lace through the center hole of each piece. Draw the $\frac{1}{8}$ -in. lace halfway through and lace down one side of the moccasin with one end. Pull each stitch very tight, butting the edges of the leather together. Do not let them lap; the seam should be flat. Keep the lace flat and untwisted. Pull very hard until each pair of holes are opposite. Lace through the last pair of holes twice and push end of lace under the last two stitches.

Lace up the other side and then, while the moccasin is still damp, either jam the toe full of paper or slip it over a piece of wood roughly shaped like your foot and hammer the seam until it is perfectly smooth and the laces are beaten down flat.

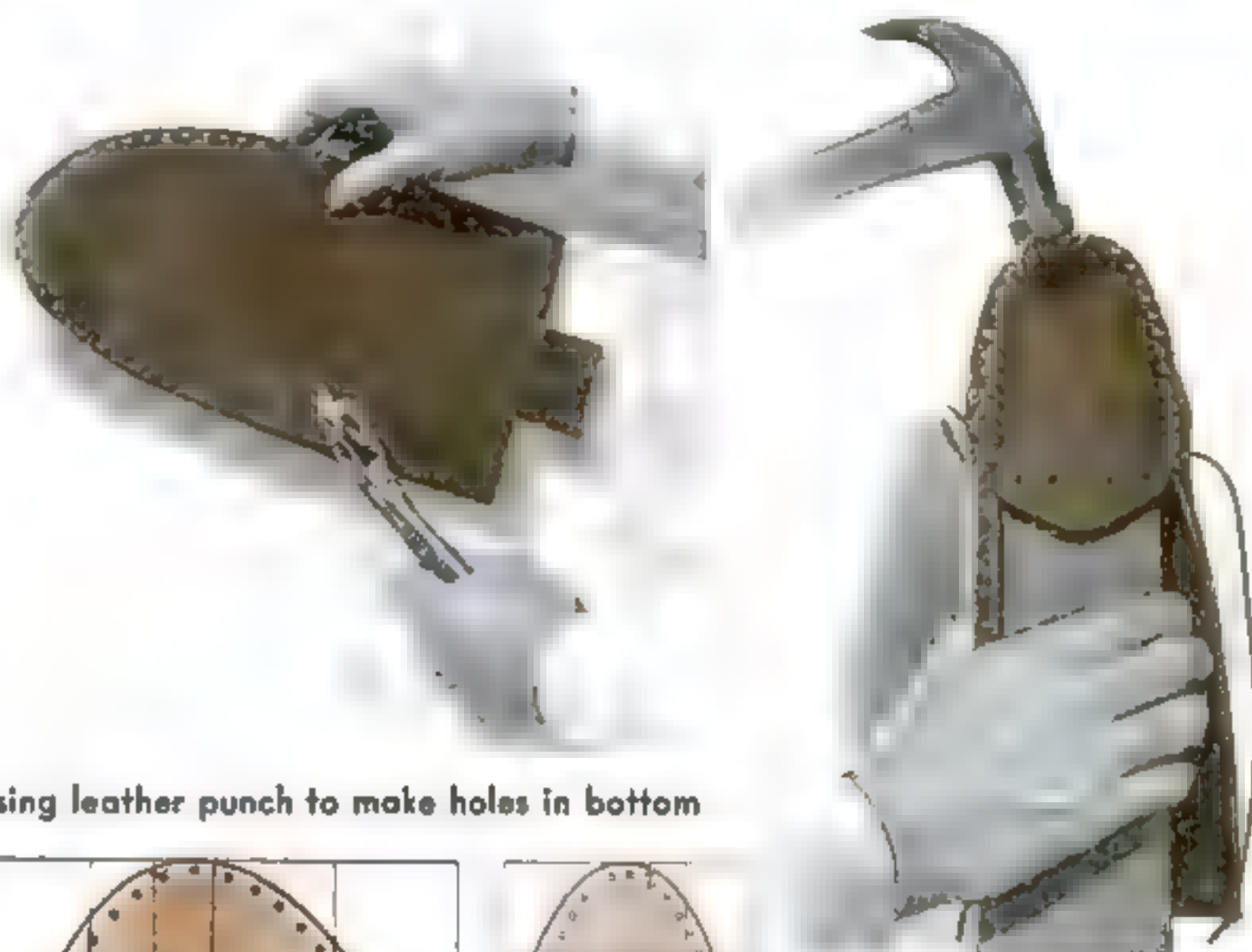
Slip the moccasin on your foot and fit the heel. Make the two heel cuts deeper if necessary, and cut off the ends of the two tabs which butt together until they fit snugly. (All pattern sizes are purposely made a trifle long for fitting.)

Lace up the heel as shown, lay it over some solid rounded object, and hammer the bends in the leather. String in the $\frac{3}{16}$ -in. ties, making the loop across the heel come outside to prevent chafing. The ends of the ties are tied into a double bow knot on top of the foot. Soak the moccasins in water again until soft, slip them on your feet over woolen socks, and walk until the leather is dry.

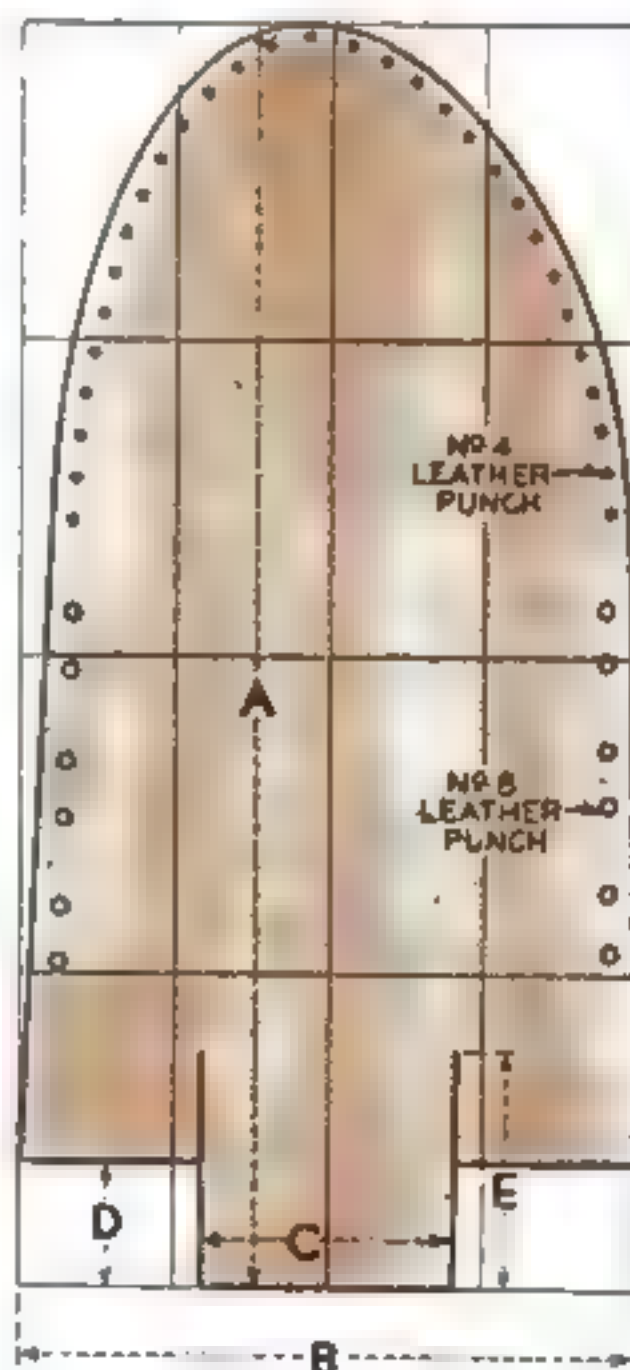
The pattern sizes are for medium to wide feet. If your foot is quite slim, make the patterns first on paper, then fold each piece lengthwise down the center and take a small tuck as shown in a sketch.



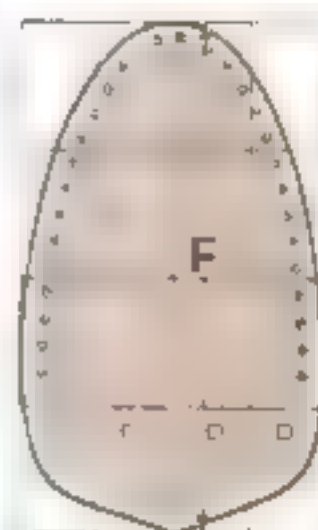
Four steps in lacing toe and bottom together



Using leather punch to make holes in bottom



The patterns. In drawing them, follow dimensions below

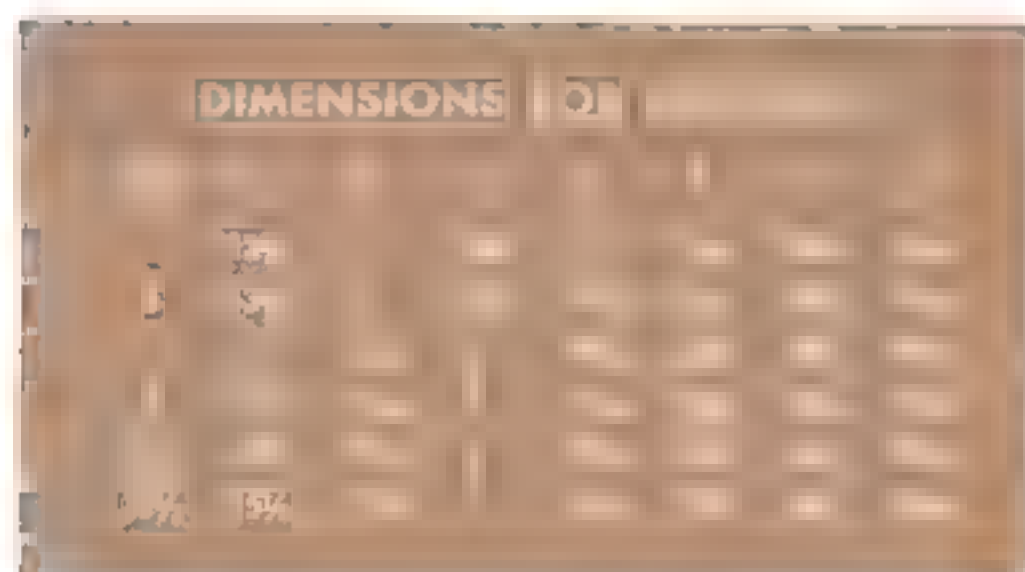


The toe is hammered over a rounded piece of wood

Sketch at left shows how to narrow a pattern, if necessary. Above, method of fastening end of the lace



The heel tabs are cut and fitted until the moccasin conforms smoothly to the foot





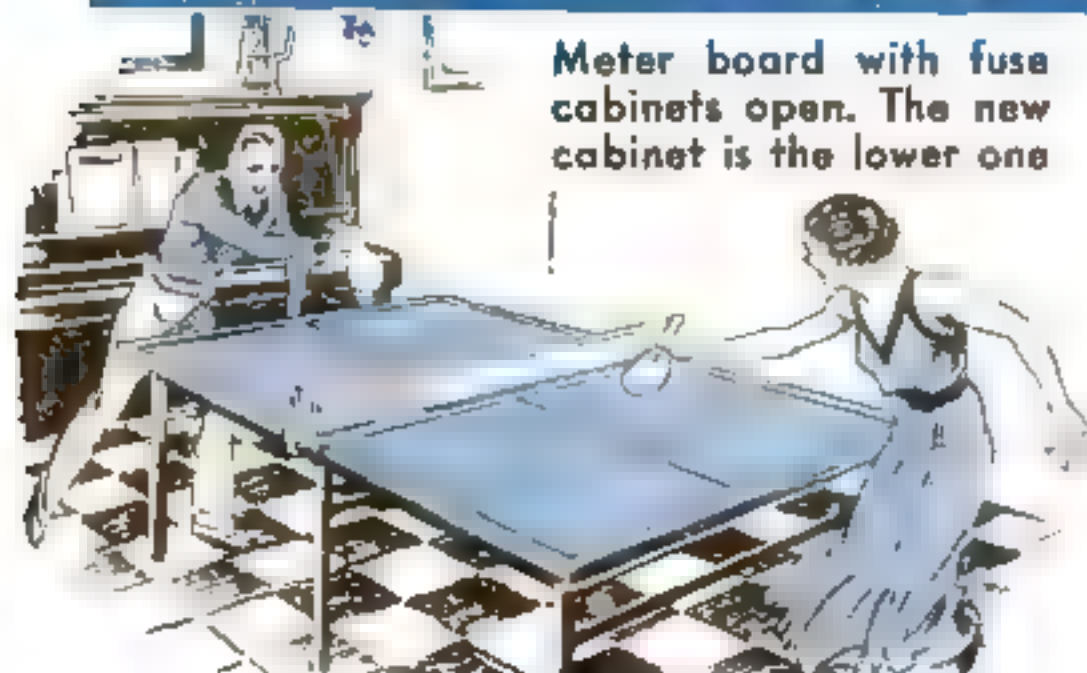
The completed game room has ten ceiling fixtures. Each has a junction box on the old ceiling over it, as shown above



Lighting a Cellar Game Room



Meter board with fuse cabinets open. The new cabinet is the lower one



IN BUILDING a game room in an ordinary cellar, the question of illumination is of the utmost importance. Not only must the wiring be properly installed to meet the National Electrical Code requirements, but the lights must be chosen to enhance the general decorative scheme. An excellent solution of the problem is shown in the accompanying illustrations.

Semiflush lighting fixtures are used because they have a distinct advantage for low ceilings. They project down only from $1\frac{1}{2}$ to 2 in. and thus give maximum headroom.

In this case a drop ceiling has been built to conceal all piping and provide an attractive paneled surface. The paneling of ceiling and walls is insulation wall board with pine strips and moldings. The color scheme is cream with Chinese red trimming. One feature is a special recess for a piano with two wall outlets on each side, equipped with paneled lantern fixtures.

One photograph shows the start of the job. Note how the studs are placed so the joints of the wall board will find support; also, in the ceiling, how pieces of wood strapping are let in between the main strapping on every other joist, likewise to provide a flat surface for the joints.

It is important at this stage to eliminate all junction boxes in the electric wiring that exists on the old ceiling. The Code prohibits concealment of a junction box in any case where it will not be accessible. In the

job illustrated, a number of these boxes had been used in wiring base outlets and brackets in the rooms above. All this wiring and boxes had to be removed. New cable was run by looping it from outlet to outlet, rather than making splices in boxes. From the nearest outlet, a single cable was run to the fuse cabinet. In this way all cable was continuous between outlets.

A junction box is placed on the old ceiling above each opening in the ceiling board. From this box, a short piece of cable is run to the sheet-metal box of the fixture, and the wires are connected to the porcelain socket. The armor of the cable serves to ground the metal of the fixture as required.

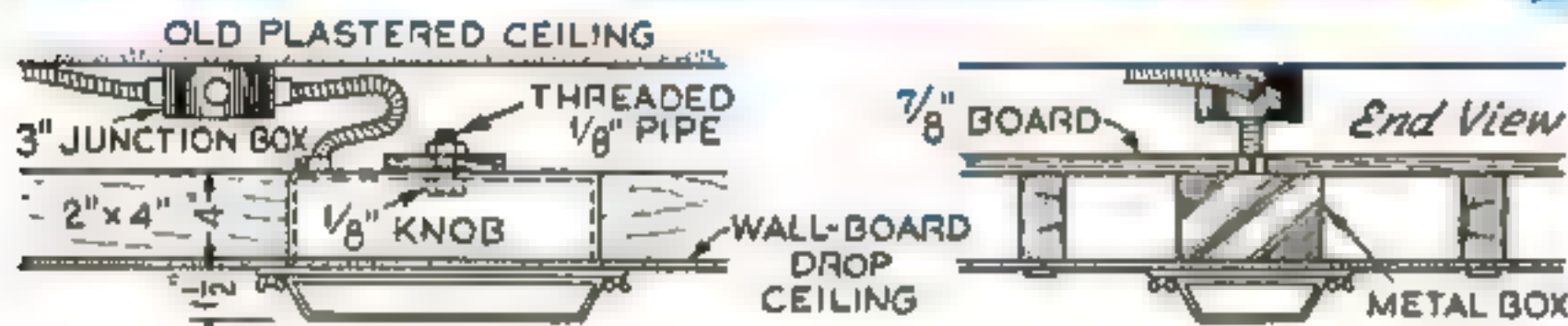
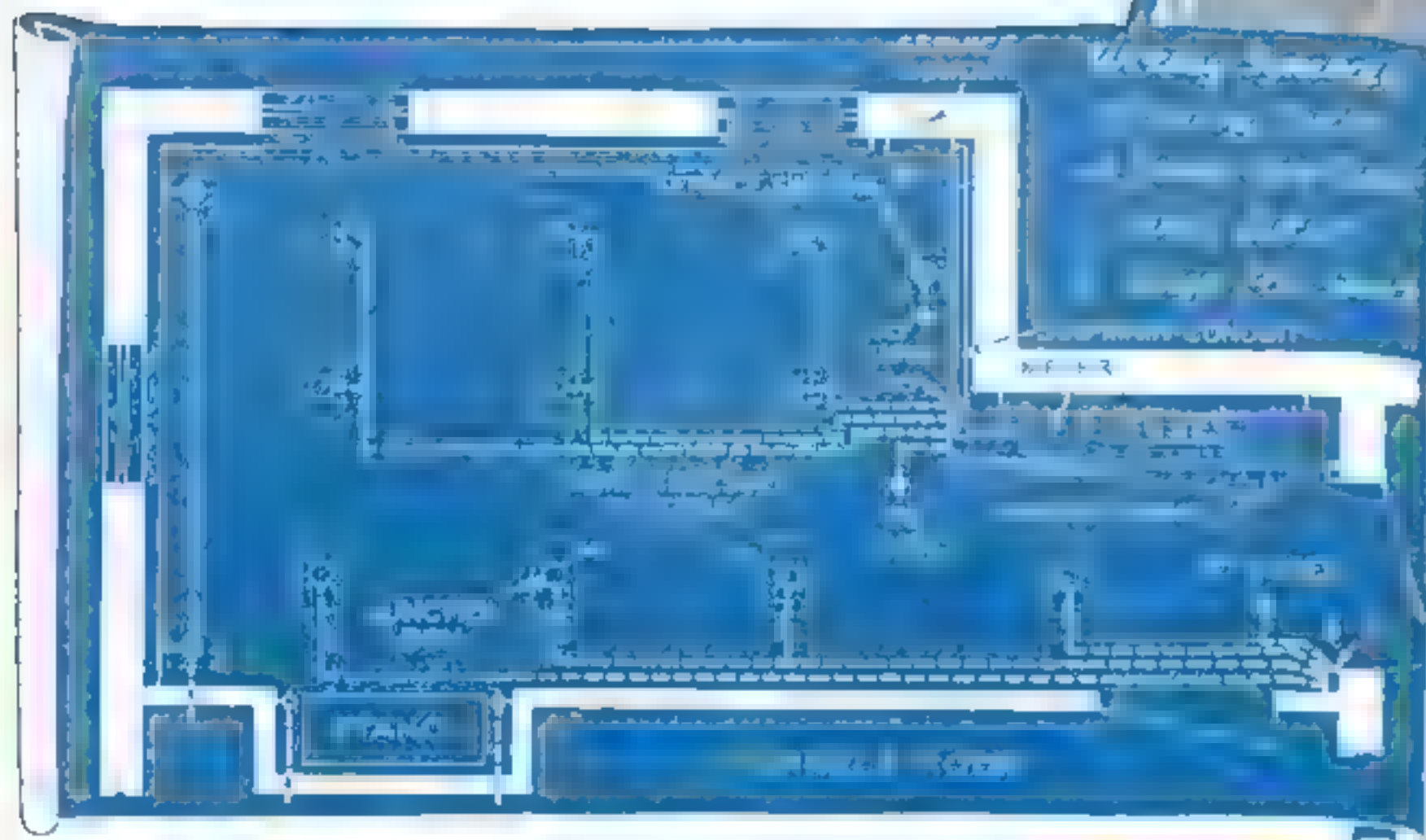
There are two methods of hanging the fixture. A $\frac{1}{8}$ -in. nipple and knob may be used, the former going through a hole in a board on top of the timber where it is held with a nut. The method in this case, however, was to drill four holes in the rim of the fixture box and attach it with wood screws. The junction box is considered accessible because it can easily be reached by removing the fixture. The outer frame with the glass panels is attached to the box with four thumb nuts. Lamps of 60 or 75 watts are satisfactory in the average case.

As shown in the wiring diagram, the lights can be controlled in groups of two in the six-light section, and the row of four lights are controlled so that the first and fourth are separate, the second and third together.

Three-gang midget switches are provided at each of the two switching

HOW TO INSTALL ARTISTIC MODERN SEMIFLUSH FIXTURES IN A CEILING COVERED WITH WALL-BOARD PANELS

By
Harold P. Strand



Wiring diagram and one way to hang the fixtures. Two wall-bracket lights, two base outlets, and electric-clock and radio outlets are also provided

points. These are of novel design because three switches can be placed under a single gang plate. One taped joint is needed in each switch box to group all the grounded wires together. The feed cable enters the bottom of the box. Joints are eliminated in connecting the black feed wire to the three switches by cleaning three bare spots in the wire and looping it around each contact screw.

The dotted lines in the diagram show which outlets are connected together to make up the circuits, but do not necessarily mean that the cable will take this exact course. It is usually run from the switch box to the first outlet on the ceiling. From this box it is carried to the next one that is controlled by that switch. This is continued, taking the shortest path for the cable, for each pair of outlets. In this manner no joints are made except in the 3-in. junction boxes over each opening in the ceiling board, and the one in the switch box.

The base and wall outlets are connected by starting with a cable from the fuse cabinet, running it to the nearest outlet, and looping a continuous run of cable from this to the next, and so on. Never attempt to make a splice in BX cable. The protecting armor must be unbroken between every outlet box.

The original fuse cabinet being already loaded, it was necessary to add a new cabinet. The entire meter board was concealed by a projection in the wall, which was built about 1 ft. deep and closed with cabinet doors, giving easy access to the fuses.

To enable the new cellar windows,

which are hinged at the top, to remain in any position, a new type of support was used. It consists of a square tubular rod that slides within another and is so made and fitted that friction will hold the window at any desired angle.

For the floor, "two by three's" were placed on the cement floor, and a double matched flooring was laid with moisture-proof paper between. It is well, however, before attempting to fix up any basement, to examine the foundation and cement floor for evidence of water and dampness. If dampness exists, it may be necessary to go outside and improve the dry wells for the conductors from the roof, which are the source of many damp cellars. A dry well should be deep, well away from the foundation, and filled with suitable stones and gravel. Sometimes a waterproofing job on the inside of the walls will answer. Attention to the grading outside should be given to see that natural surface drainage is away from the house, if possible. A cement apron built around the house and extending down quite a distance below the ground level, with a sloping top, is often effective in shedding water. The cellar must be reasonably dry at all seasons.

The wall studding and ceiling timbers were erected at the outset



Three-gang midget switches are installed. The feed cable enters the bottom of the box. Left, a single gang switch plate is used



Windows are held open in any position by a square tube-and-plunger type of support



Motor-Boat Ropes Kept Coiled Below Deck

BY THE use of a simple deck fixture made from a discarded propeller-shaft stuffing box, the bow or stern line of a motor boat can be kept in a rope locker below the deck and still be as easily accessible as if it were coiled on deck.

The stuffing box is passed through a hole in the deck, with the flange below, and fastened by tightening the lock nut.

The packing is removed from the nut, and the shaft hole filled with a bottle cork or wooden plug, cut off flush and painted.

A spliced loop in one end of the rope is fastened to the packing nut by a brass rod passing through two holes in the threaded portion of the nut. The other end of the rope is threaded down through the hole in the stuffing box and fastened securely below the deck or tied to a ring too large to come up through the hole. The rest of the rope is then fed into the locker, where it will automatically coil itself; and the threaded cap is given a turn to keep it in place.—GUY A. RAFUSE.



Model Warning Signal

MADE FROM PHOTO

size on smooth paper, disregarding the upright. On a $\frac{1}{4}$ -in. scale model railroad, or "O" gauge, the signal should be $1\frac{1}{2}$ in. across. Glue these prints on thin plywood and saw to the outline.

For the poles, cut $\frac{1}{8}$ -in. dowel stock, or small taffy sticks, about $2\frac{1}{4}$ in. long, and glue or nail them to the signal part. Bases can be made from small blocks of wood, or holes can be drilled directly in the platform to take the poles. Finish the signal by smoothing up all the edges with fine sandpaper, and give the wooden portions two coats of white paint.—C. ELMER BLACK.

TRUE-TO-LIFE warning signals for the grade crossings of a model railway may be made photographically.

With any type of camera, take a photograph of the warning signal at a real grade crossing. From the negative obtained, make enlargements of suitable

Dispensing Powder from a Bottle

SUGAR, granulated hand soap, and powders of various kinds that are used in small quantities in the home, shop, or camp can be kept conveniently in a bottle with a hard rubber or composition cap of the type illustrated. A $\frac{1}{4}$ - or $\frac{3}{8}$ -in. hole is drilled in the cap to convert the bottle into a dispenser.—A. J. VIKEN.



Building Miniature Roads

IN MODEL railway layouts it is desirable to have a clean-cut separation between the sand roads or other types of roads and the moss or other material used for the ground. I tack lengths of discarded clothesline rope to the platform where the road edges are to come, then fill in with sand and place the moss on either side of the road.—VERNON N. KISLING.

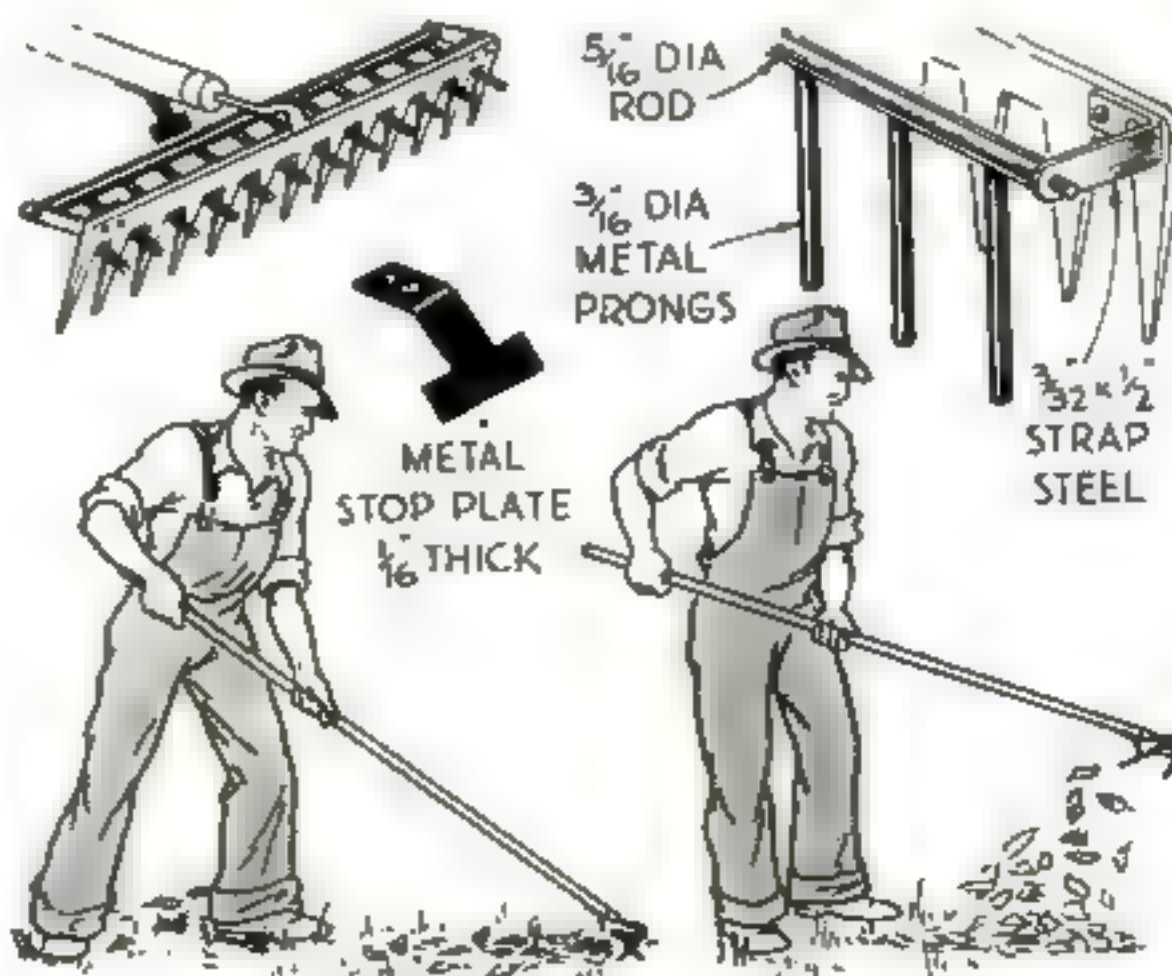
Attachment Frees Rake of Leaves

TO KEEP leaves and grass from sticking to the prongs of a rake, a swinging device may be made as suggested in the drawings below. The $\frac{3}{16}$ -in. diameter prongs are

welded to a $\frac{5}{16}$ -in. diameter rod, which is mounted on the rake proper by means of two metal arms. These arms are preferably welded to the upper corners of the rake, although they may be bent at right angles and riveted on. The rear ends are drilled to take the $\frac{3}{16}$ -in. ends of the prong rod. These pivot points should be well oiled so the prongs will swing freely.

A metal stop plate $\frac{1}{16}$ in. thick is fastened to the pole a short distance back from the prongs of the rake as illustrated at the left.

Near the end of the back stroke, the rake is lifted up, and just as the forward stroke is begun, gravity and inertia swing the auxiliary prongs with sufficient force to sweep off the accumulated grass, leaves, and twigs.—D. W. C.



The rake is fitted with an auxiliary set of prongs that swing back and forth, sweeping off all grass and leaves

Craftwork on Display

NATIONAL HOMEWORKSHOP GUILD CLUBS WIND UP SEASON WITH MANY EXHIBITIONS

THOUSANDS of projects—including inlaid pictures, furniture, toys, models, and novelties—have been exhibited by home workshop clubs in hardware-store windows and vacant stores, Y.M.C.A.'s, and in conjunction with hobby shows in many cities and towns throughout the United States and Canada during the past few months.

Made by members of the National Homeworkshop Guild, the work shows what fine craftsmanship can be attained by amateurs. The exhibits have been viewed by hundreds of thousands, and the interest displayed indicates that the Guild will experience greater activity in the fall than ever before.

More than two thousand adults, besides hundreds of children, inspected the third annual exhibition of the North Shore Craftsman Club at *Waukegan, Ill.* Wesley Biastock was awarded a lathe for the furniture he entered in the show; Charles Stone won a bench vise with his wood carving; David Lundgren, carving chisels, awarded for wood carving; C. W. Clark, abrasive tools, for model boats; Yale Shellenger, a trade certificate, for a model of the battleship *Texas*.

Blue ribbons were presented to Captain Anderson for mounted birds and



G. N. Schalk, Wood-Ridge, N.J., with walnut china closet that won a special medal



Annual exhibition staged by North Shore Craftsman Club, Waukegan, Ill. There were more than 2,000 adult visitors

animals, Arland Jack for a sailboat, C. F. Cremer for a model locomotive, and A. E. Green for inlaid and scroll work. Boys who won prizes for model airplanes were Wayne Potter, M. Velcover, B. Hawkins, and W. Sayles. Judges were Mayor Mancel Talcott, Dr. L. W. Yates, C. W. Dickinson, and C. F. Cremer.

G. N. Schalk won a special silver medal for the best craftsmanship displayed at the annual exhibition of the *Wood-Ridge (N. J.)* Homeworkshop Club. It was a walnut china closet which brought him this honor. The same piece also received the most ballots in a popular vote,

but had to be rated third since under the contest rules he was ineligible for the first or second prize because he won first prize last year. First award went to C. D. Chase for a veneered checkerboard card table; second, L. J. Messenger, walnut sewing cabinet; third, Mr. Schalk; fourth, H. Hagemann, walnut writing desk; fifth, H. L. Fritts, inlaid pictures; sixth, H. G. Hoffman, walnut telephone table and chair.

The show was held in a vacant store and attracted nearly 400 adults. There were sixty-five pieces on display.

Robert B. Dyer has been elected president of the *Lincoln (Nebr.)* Homeworkshop Club; J. L. Witmer, vice president; H. L. Culver, secretary-treasurer. Meetings have been discontinued; however, when they are resumed in the fall, each member is pledged to bring one new member . . . Because some of the members work at night, the Gem City Homeworkshop Club of *Dayton, Ohio*, meets on Saturday afternoons. . . The Woodcraft Homeworkshop Club of *Kincaid, Kans.*, has completed a wooden-shoe project and is now making three looms. . . *(Continued on page 108)*



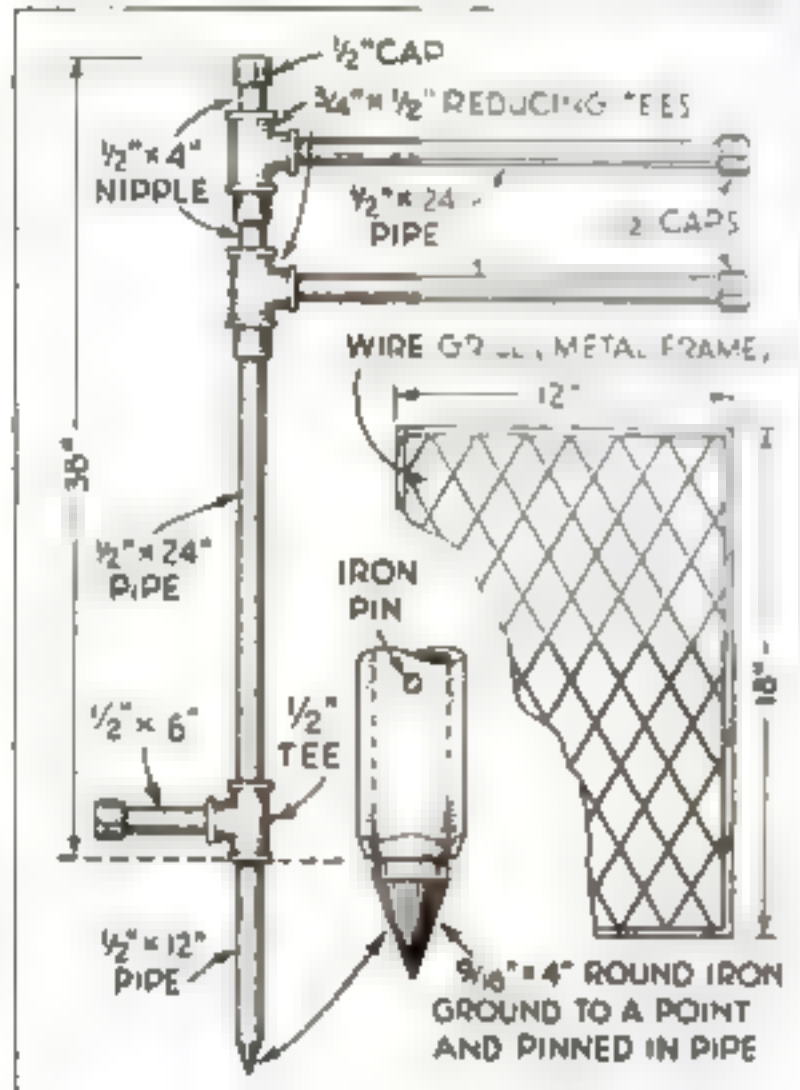
The 1937 exhibition of the Galesburg (Ill.) Homeworkshop Club was held in a furniture-store window. Prizes amounting to \$130 were awarded to various members

Portable Crane for Camp Cookery

WITH this portable, double-duty camp cooking crane, it is equally easy to boil, fry, or grill. The two arms may be swung over the fire or brought around to the cook as required. One is 5 in. higher than the other to give a different cooking distance from the fire, and further adjustments are made by the use of pothooks, which may be linked together to lower the cooking utensils.

Since it is made of pipe fittings, the crane can be quickly taken apart and folded in a canvas roll. It is desirable also to make canvas slips for the grill, skillet, and kettles. Kettles should be selected so they will nest together, and paper is placed between them to keep the insides clean and prevent rubbing together.

The materials for the crane are: 3 pc. $\frac{1}{2}$ -in. pipe, 24 in. long, threaded both ends; 1 pc. $\frac{1}{2}$ -in. pipe, 12 in. long, threaded one end; 1 pc. $\frac{1}{2}$ -in. pipe, 6 in. long, threaded both ends; 2 nipples, $\frac{1}{2}$ by 4-in.; 1 straight tee, $\frac{1}{2}$ -in.; 2 couplings, $\frac{1}{2}$ -in.; 4 caps, $\frac{1}{2}$ -in.; 2 reducing tees, $\frac{3}{4}$ by $\frac{1}{2}$ -in.; 1 pc. 9/16-



S-shaped pothooks, each made from a 6-in. piece of No. 6 wire.

Assemble the parts as shown, be-

ginning with the foothold. The three pieces that form the foothold and the entire top assembly of seven fittings are each kept permanently together.

Unless the ground is very hard, pushing down on the foothold will drive the point in. Locate the crane on the windward side of the fire so that the cook can swing the pots or grill around to him on the cool side.—W. W. WHEATLY.

in. round iron, 4 in. long; 2 pc. light chain about 40 in. long, or old tire chains with the crosspieces removed; 6 or more



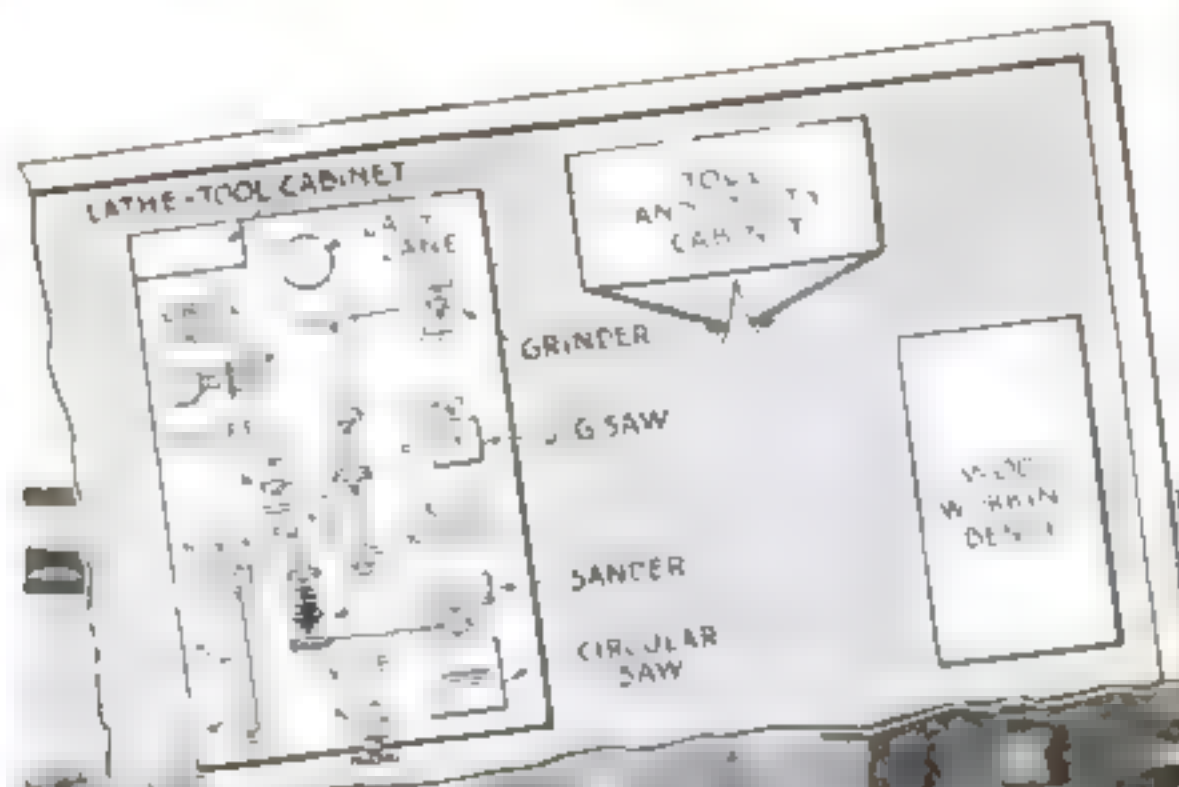
Made as at the left, the crane is quickly set up and taken down

A Space-Saving Workshop Layout

IN THIS workshop layout, a 1/3-h.p. motor serves for all machines but the drill press. The operating mechanism is accessible from either side of the power table, and the woodworking

equipment is on the side nearest the tool cabinet and woodworking bench. The motor has a reversing switch to drive machines on either side of the table. There is a separate switchboard on the wall for motor outlets, switches, fuse block, and the like. In case of an overload, a cut-out block protects the house fuses.

Centered above the power table is a swinging light made from a discarded telephone extension bracket.—HAROLD A. DEHN.



Removing Loose Paint from Concrete Floor

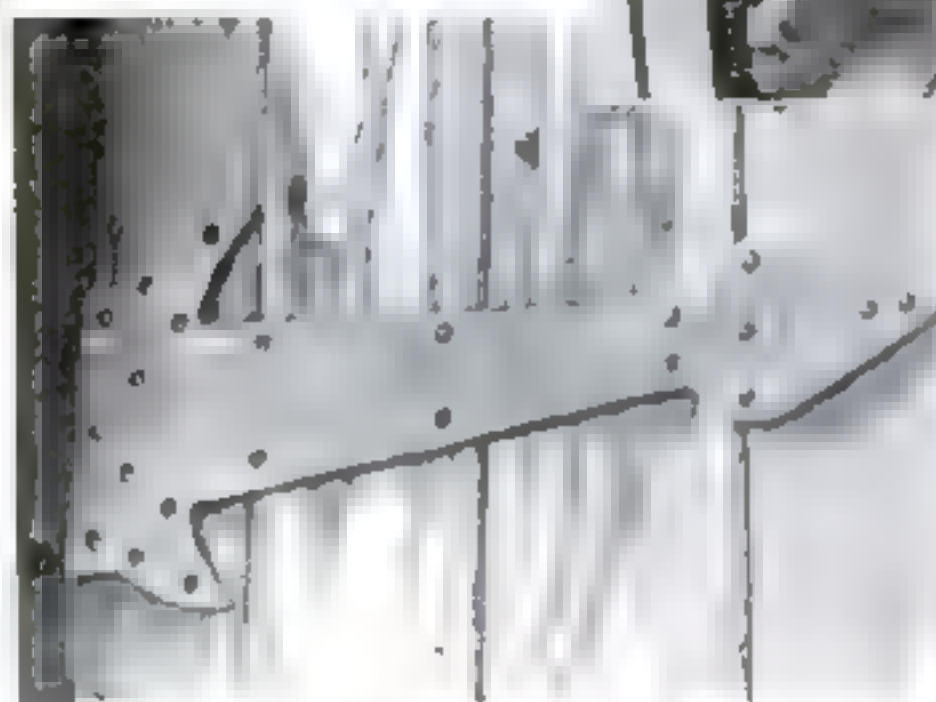
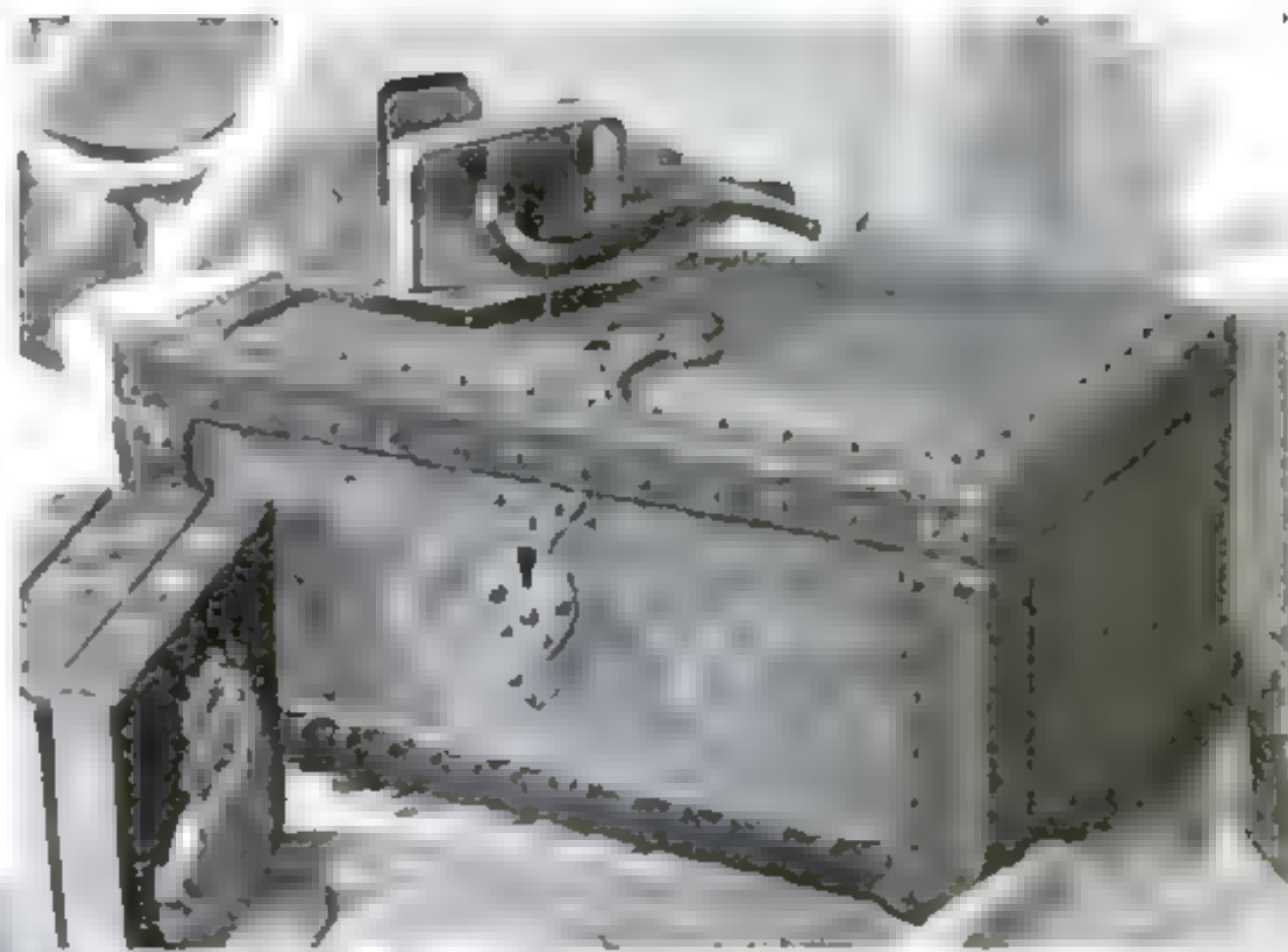
TO SCRATCH-BRUSH paint blisters from a concrete floor before repainting, an electric drill was used with a wire brush as illustrated above. The handle was supported on a roller skate. By varying the pressure, the edges of the cleaned spots were tapered off smoothly to the surrounding paint.—E. S.

Decorative Hardware

FROM SHEET LEAD



Small pirate's chest bound with lead obtained from old water pipe. Left, squaring the edges of a lead-covered hinge strap



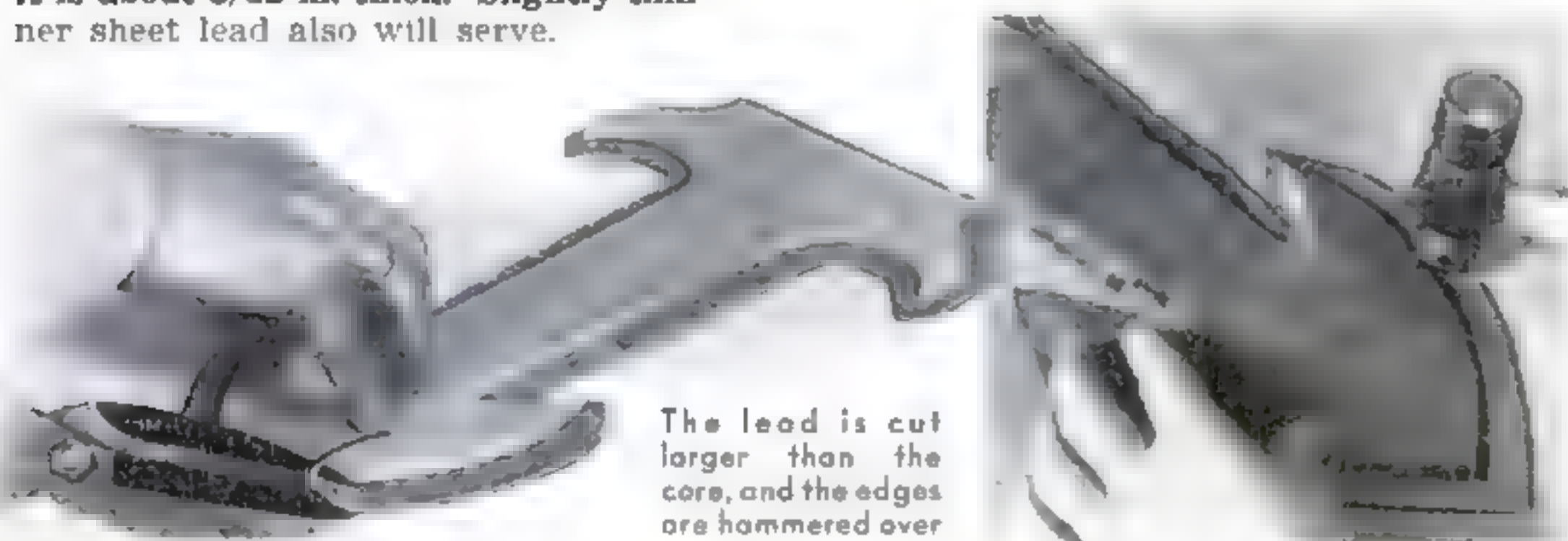
After seven years' exposure, this lead-and-wood hinge strap is as good as when made

One great advantage of using lead, aside from its workability, is that it will not cause stain marks on woodwork when exposed to the weather, provided it is attached with brass screws. It may be left in the natural color or painted flat black.

The writer's first experiments were made with lead water pipe when he was still in school. It was split down the side, flattened, beaten to the desired shape and surface, and used to decorate a small pirate's chest. The rivet heads were reproduced by using large square-headed cobble nails.

In making surface hardware over a wooden core, the steps are as shown. When cutting the metal with tin snips, allow sufficient to wrap around the edges of the form and over onto the back. The lead will bend in such a way as to leave round edges, but this is easily overcome by placing the covered form in the vise and beating the edges square.—REGINALD O. LISSAMAN.

MASSIVE wrought-iron hardware is surprisingly expensive, but an acceptable substitute may be made by using sheet lead over a core of plywood. The lead commonly used for flashing around soil-stack vents where they pass through the roof is suitable; it is about 3/32 in. thick. Slightly thinner sheet lead also will serve.



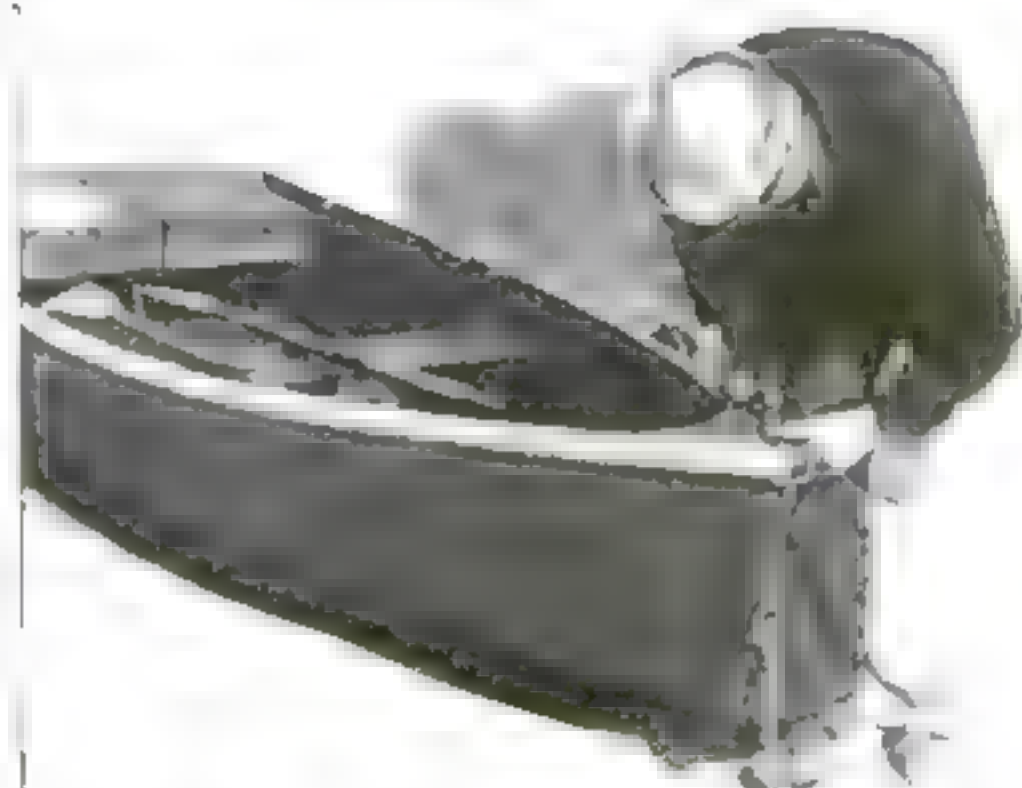
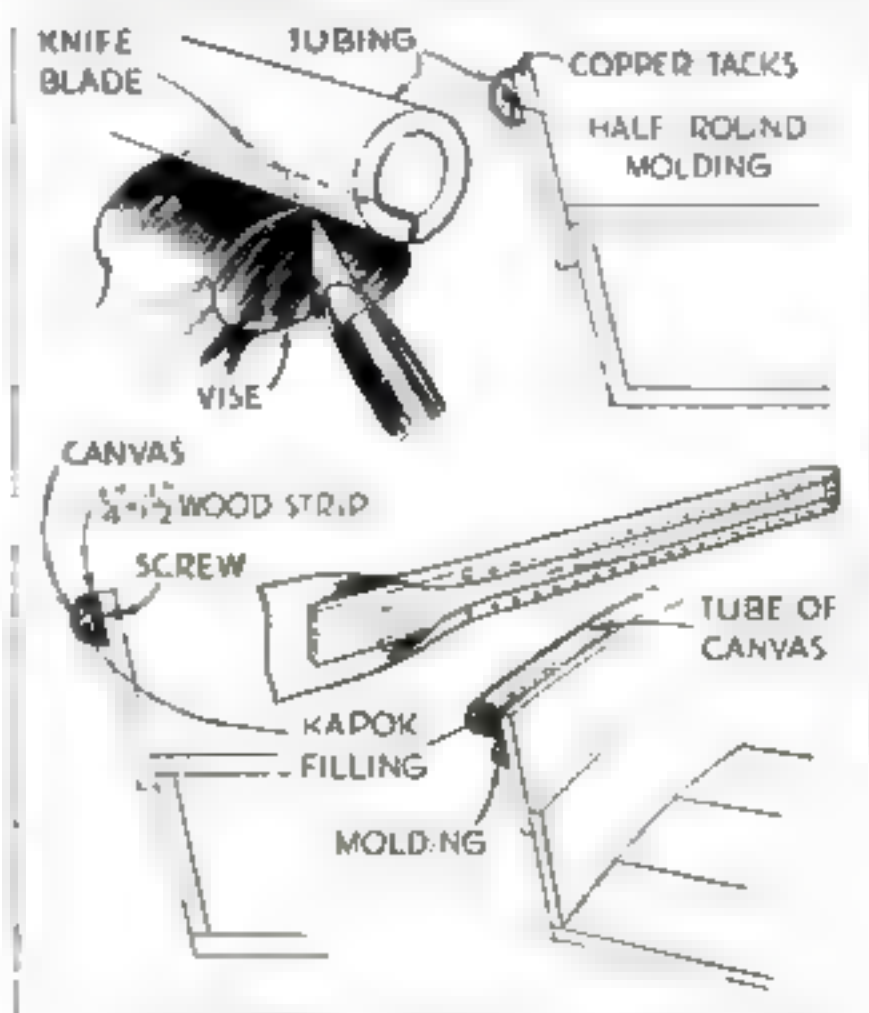
The lead is cut larger than the core, and the edges are hammered over

THREE WAYS TO MAKE FENDERS FOR SMALL BOATS

IF A BOAT already has a half-round molding at the gunwale, the simplest fender is obtained by slitting a suitable length of 1-in. diameter white rubber tubing and applying it with copper tacks spaced 2 in. apart. A short length of the same material should be tacked over the stem.

A thick, soft fender, easily removed when painting time arrives, may be made by tacking a loose covering of heavy white canvas to a length of 1/4 by 1 1/2-in. white pine or cedar and packing it with kapok. Pack and tack about 10 in. at a time. Fasten the fender with short brass screws started from inside the boat.

When a fender is required to afford a yacht protection against both side and upward thrust of the tender, make a tube of heavy white canvas about 10 in. wide and pack full of kapok.—W. E. STEWART.



A rubber-tubing fender is neat and serviceable. Canvas packed with kapok also may be used



HOW TO COMPLETE OUR NEW Racing Sailboat

WHEN our new racing sailboat *Blackcat* has progressed as far as described in the previous article (P.S.M., July '37, p. 71), the remainder of the deck frames and the breasthook, mast partner, and cockpit carlings can be put in, lined up, and dressed down until perfectly true and fair to take the decking.

The centerboard trunk should be made as shown in the drawings last month, with the bottom side carefully fitted to the curve of the keel. Paint the inside before assembling. Screw the trunk to the keel from both sides with 1½-in. No. 10 and 2½-in. No. 12 screws, having first laid a gasket of canvas or cotton flannelette soaked with white lead or marine glue. The end pieces of the centerboard trunk should extend through

the ½-in. wide slot cut through the keel.

Cut slots for the mast in the partner and mast step, and paint the entire inside of the hull before starting on the decking.

The decking should be laid in not over 4-in. widths. Paint the deck boards underneath before they are put on, and fasten them with 1-in. copper or galvanized iron nails. If the boat is to be left out in the sun, the deck should be covered with canvas or heavy muslin, laid in thick paint or canvas cement, stretched tight, and tacked around the edges. The edges will be covered later by the half-round sheer molding and the cockpit coaming.

The rudder and tiller should be made of ¾-in. oak. Fasten the sections of the rudder together with ¼-in. metal dowels and several 2½-in. No. 12 screws.

A square hollow mast, preferably of spruce or fir, is desirable because it is strong and light. It should be made solid as far up as the gooseneck, and at the top and point where the tangs are fastened. The ¾ by 1-in. piece should be put at the back for fastening the sail track. Assemble the mast with waterproof casein glue, clamping the parts tightly together while the glue is drying. The T-shaped boom also should be of spruce or fir, fastened with screws or casein glue.

The entire hull should be well sanded before the priming coat is put on. Afterwards the screw holes should be covered with (Continued on page 113)

Fastening pulleys for the sheet rigging. Note also how the rudder is hung with pintles and gudgeons of the standard type

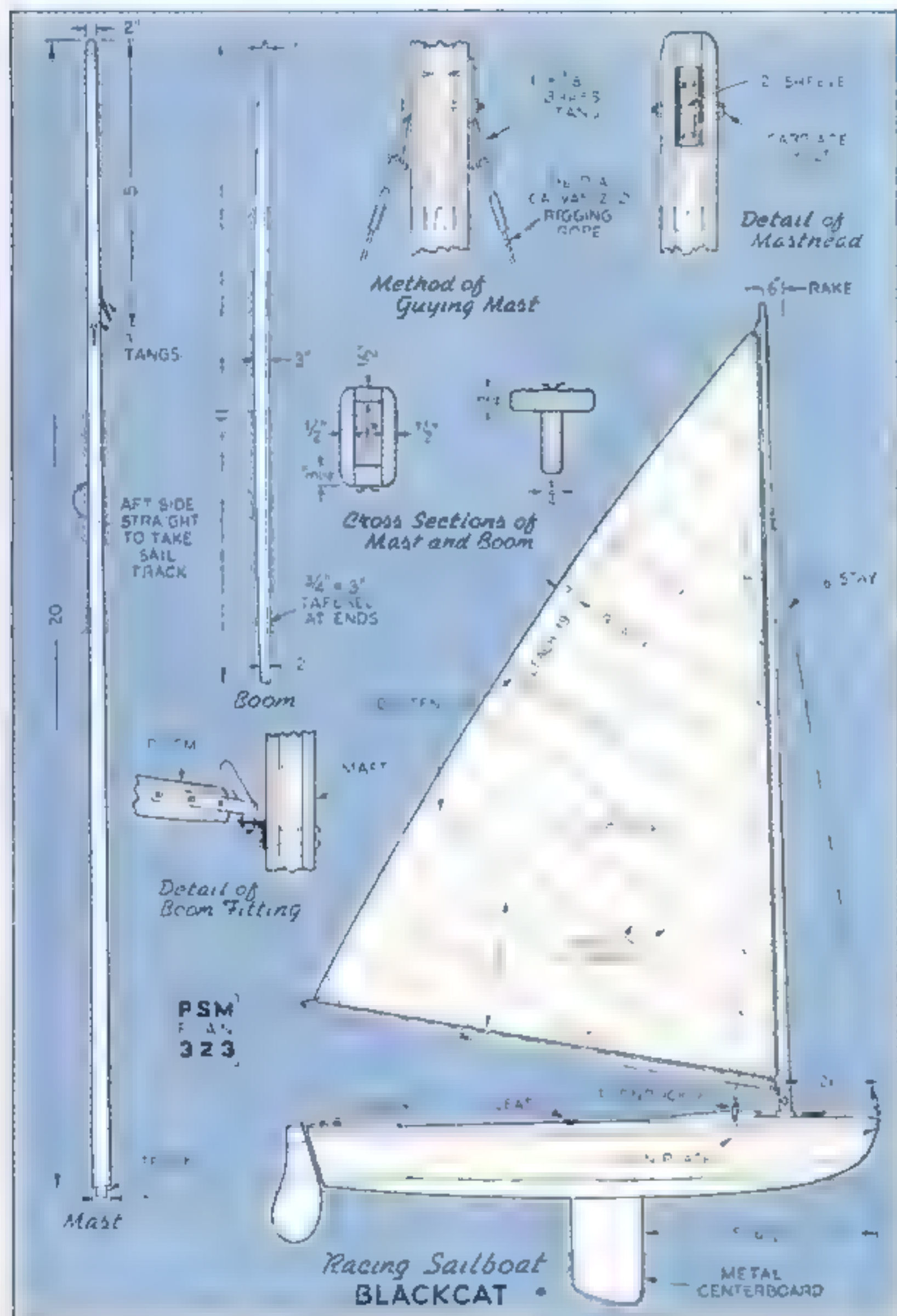
Deck supports are screwed to bottom frames, deck beams, and cockpit carlings. Right, screwing centerboard trunk to keel



Two or three strands of twisted cotton wicking should be used for calking each seam. A calking wheel will do a good, fast job and insure tight joints

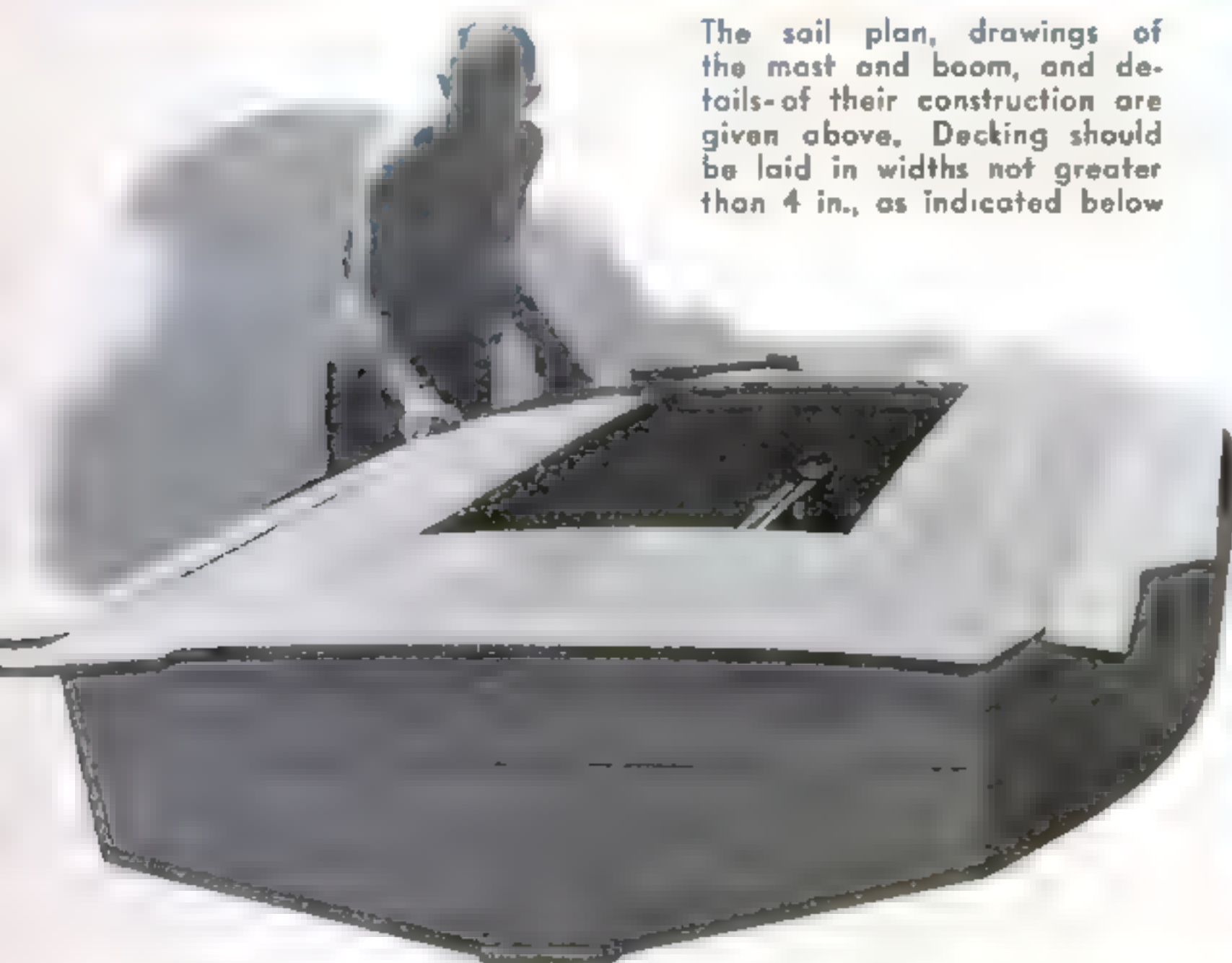


'BLACKCAT'



"Blackcat" is 13 ft. 4 in. long—a very fast, seaworthy boat. The mast is held with wedges as at the left

The sail plan, drawings of the mast and boom, and details of their construction are given above. Decking should be laid in widths not greater than 4 in., as indicated below



A boom crutch should be provided to hold the boom whenever the sail is off the boat. The hull is now complete, with all its rigging

A Tester for Steadiness of Hand

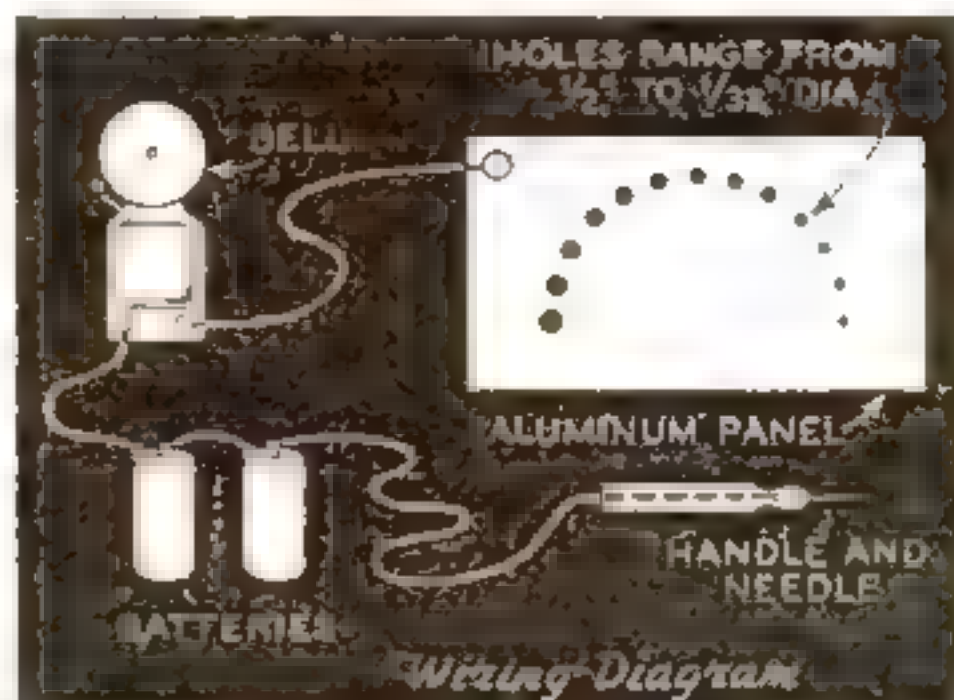
A "NERVE TESTER" like that illustrated will furnish much entertainment at parties, and it is an excellent science project for high-school pupils to make.

The aluminum panel which forms the front of the box has a series of holes varying uniformly in diameter from $\frac{1}{2}$ to $\frac{1}{32}$ in. The individual who is undergoing the test is given a needle set in a handle and asked to insert the point in each hole in succession and withdraw it without touching the side of the hole and without using any support for his hand. If he does touch the metal, an electric bell rings. The object is to see how small a hole he can reach before this happens.

The box and panel may be any convenient size. The door-bell and battery are placed in the box and are connected as shown in the diagram. It is well to provide a binding post on the side of the box for connecting the flexible wire leading to the needle.

The model illustrated was made as a science project by Paul Bevan and Rufus Issleib, eleventh-

year pupils in the Phineas Banning High School, Wilmington, Calif. It has been used in connection with psychology tests.—M. H. COMPTON.



The object is to insert a needle point into each hole, beginning with the largest. If the needle touches the panel, a bell rings



Screw driver with a spring clip for holding either machine or wood screws

Starting Small Screws

SMALL screws may be started easily in tight, unhandy places with a screw driver to which a thin strip of spring brass, about $\frac{1}{8}$ by 2 in., has been fastened with a rubber band and bent to hold it against the screw head.—ROBERT J. WILLIAMS.



Above, the added parts. At right, stamp with name in printing position



How to Combine Name and Date Stamp

ALTHOUGH it does the work of similar devices costing several dollars, the combination name-and-date stamp shown above was made for about fifty cents, plus a few pieces of scrap brass.

A small box or tray is formed as at A to hold the rubber type with its backing pad. To the tray are soldered two arms, and these are screwed to the frame of an ordinary dating stamp. If the name is very long, the arms are bent as shown at B.

One view shows the tray mounted for normal use. If the date alone is required, a small piece of paper is slipped under the name.

Since this is a nuisance if many successive date impressions are required, the two forward screws are removed and relocated so that, when desired, the tray can be raised out of the way as shown at the left. The stamp thus acquires a feature not found in the purchasable types.—A. H. HONEST.



The stamp with name tray raised so as to permit the date stamp to be used by itself

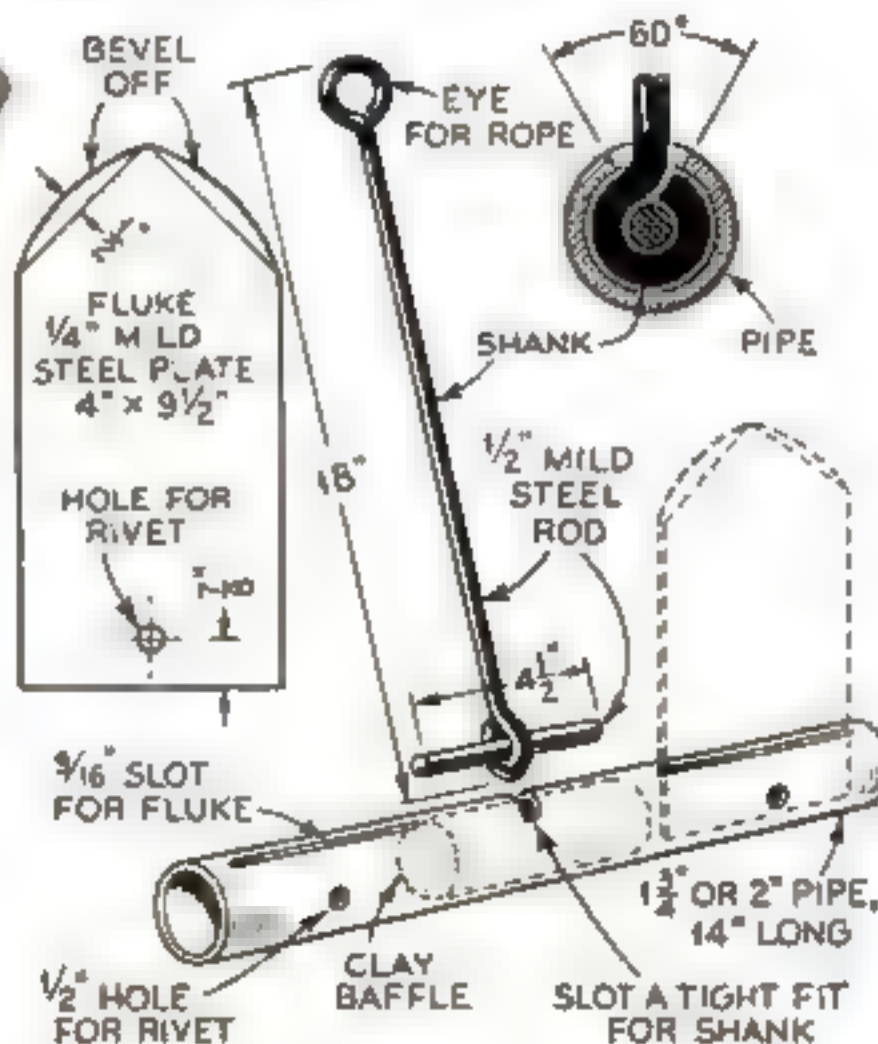
Anchor for Small Boat Costs Little



Although simple to make, this anchor is of an improved and efficient type

A HIGHLY efficient navy-type anchor for a small boat may be made from a piece of $1\frac{1}{4}$ - or 2-in. pipe 14 in. long, about 30 in. of $\frac{1}{2}$ -in. mild steel rod, a piece of 20 by 4 by $\frac{1}{4}$ -in. mild steel plate, and about 10 lb. of scrap lead.

To form the slot in the pipe for the shank, drill two $\frac{9}{16}$ -in. holes about 2 in. apart and cut the metal away between them with a hack saw. The slots for the flukes are made by drilling $\frac{1}{4}$ -in. holes, starting about 1 in. from each end. File the slot to fit the fluke tightly. At right angles to the slot, drill a $\frac{1}{2}$ -in.



hole for the rivet that holds the fluke.

When assembling, set the shank in place, drive a $4\frac{1}{2}$ -in. piece of the mild steel rod through the eye to secure it, and pack clay tightly around this as indicated to dam the molten lead. Then, after the flukes have been riveted in place, pour the lead in to hold them more securely and to add the necessary extra weight.—G. RANKINE.

SENSITIVE
Balance
BUILT FROM
SCRAPS

ALTHOUGH it will weigh to a fraction of a milligram, this beam balance did not cost me a cent. It was built entirely from scraps and salvaged materials.

Column. A 1½-in. wooden dowel about 12½ in. long is set as shown at a slight angle in a hole bored in the base. A wooden bracket is fastened in a slot in the top to hold the knife-edge bearing, which is an iron washer with a nick filed across its upper face. Fasten the washer with small screws.

Beam. Cut from white pine. Bear in mind these facts: 1. The point of support (central knife edge) must be above the center of gravity of the finished beam, complete with indicator and adjustment screw, but the shorter the distance between these two points, the greater the sensibility or, as it is more commonly called, the sensitivity. 2. All three knife edges must be in the same plane. 3. The longer the power arms, the greater the sensitivity and the longer the period of oscillation; however,



Turning a knob to draw down the oscillation arrester, which is merely a pair of wire arms fastened to a T-shaped wooden device in rear

By DALE W. ANSELL

the beam must be rigid. 4. The lighter the beam, the greater the sensitivity.

A section of razor blade is set securely in a slot in the beam, perpendicular to the plane of the beam. The indicator is iron wire, flattened and pointed at one end. The other end is inserted in the beam.

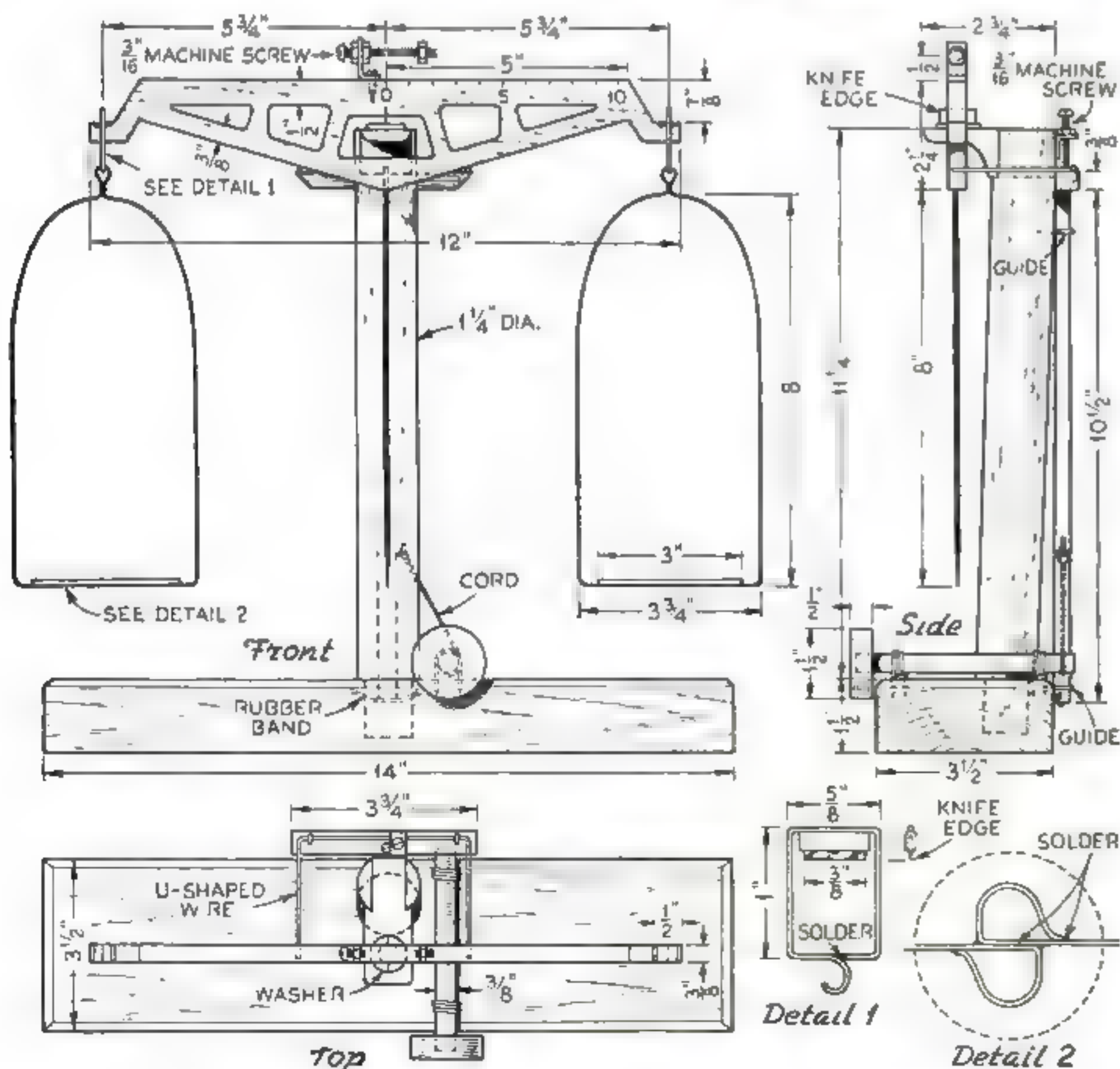
On top of the beam, fasten a metal bracket to hold the adjustment screw. Inlay iron plates in extreme ends of beam and file a nick in each to locate the knife edges. Nicks must be same distance from central knife edge and perpendicular to plane of beam.

A scale of ten divisions, each being 12 millimeters, is drawn on thin white paper and glued to the right edge of the beam for the rider (described later). The zero mark is located directly over the central knife edge.

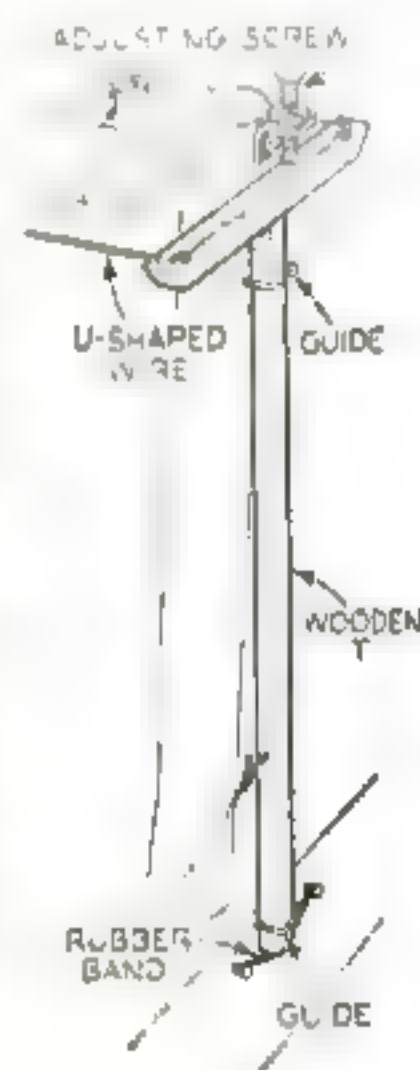
To test for the beam's center of gravity, tie a nail to one end of a piece of strong thread and a weight to the other. Hang the beam from one end on the nail, and the plumbed thread will pass through the projected center of gravity. Since the center of gravity may be assumed to lie on the vertical center line of the beam, the point where the thread crosses this center line is the center of gravity.

Pans. The supports are iron wire, bent and soldered. The pans are sheet copper disks. The knife-edge hanger is tin, bent double to hold the knife edge and soldered to a piece of wire bent to form the hook.

Oscillation arrester. A wooden T is made, 11 in. long, 4 in. wide. A U-shaped piece of wire is fastened to the bar of the T so the arms of the U extend far enough forward to support the (Continued on page 113)



Top, front, and end views of the complete beam balance, and two detail drawings, the first showing the knife-edge hangers and the second, the pan supports bent from wire

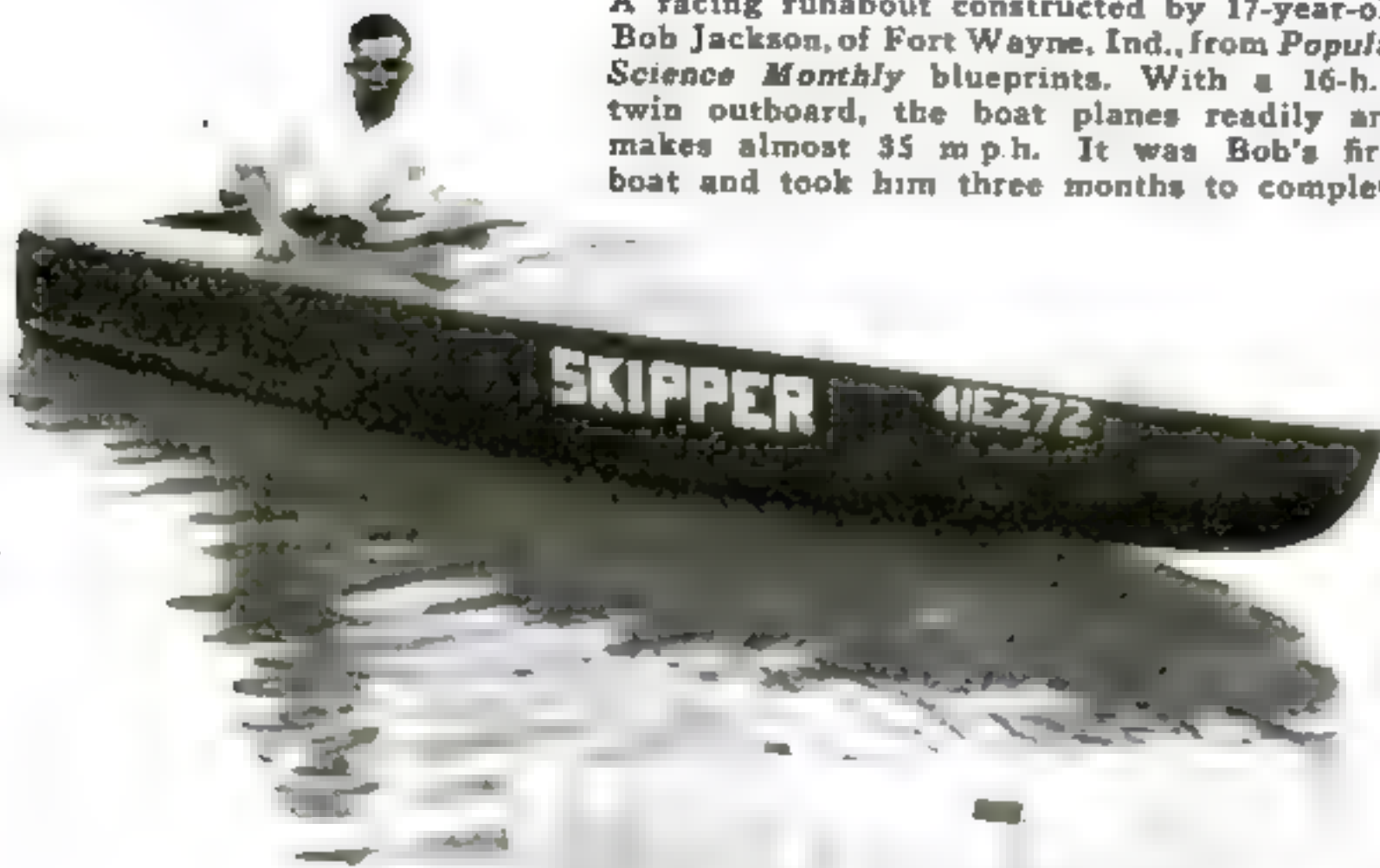


How oscillation
arrester is held
on the column

Built by Our Readers

Boats, Models, and an Automobile Reveal Skillful Craftsmanship

A racing runabout constructed by 17-year-old Bob Jackson, of Fort Wayne, Ind., from *Popular Science Monthly* blueprints. With a 16-h.p. twin outboard, the boat planes readily and makes almost 35 m.p.h. It was Bob's first boat and took him three months to complete



"HARTFORD" MODEL

Model of the famous Civil War sloop-of-war *Hartford* built from *Popular Science Monthly* plans by D. O. Seamon, of Terre Haute, Ind. The work took approximately 1,400 hours. All the details are of wood except deadeyes and blocks. The model is 41 in. long over all and stands 25 in. high. The vessel is famous as Admiral David G. Farragut's flagship



CATAMARAN BUILT BY DENTIST

"I can't think of anything half as easy to build, yet so fast and safe," writes F. A. Graham, D. D. S., whose hobby is sailing on Lake Michigan. Each pontoon is made of four boards, 10 in. wide and 20 ft. long—two boards for sides and two for the bottom—and has a canvas deck. The centerboard is $\frac{1}{4}$ -in. steel plate, 3 by 4 ft. The A-masts are hinged at bottom to fold down so the whole rig can be run into a boathouse. The craft draws about 4 in. with the centerboard up

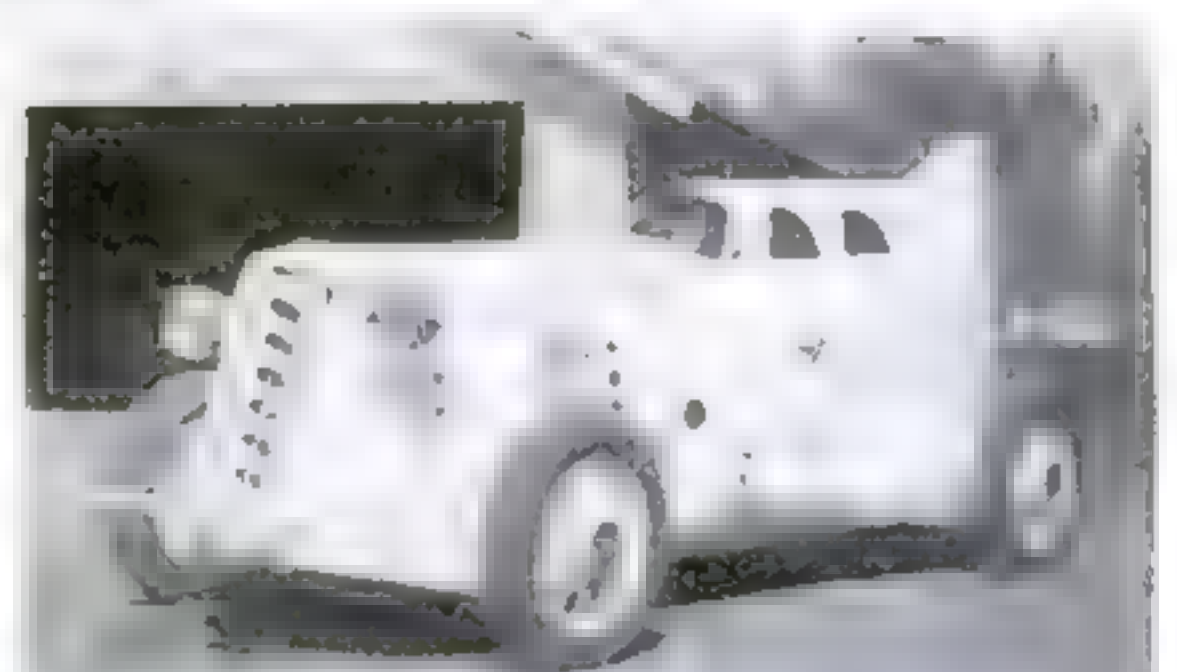


MODEL OF MT. VERNON HAS 3,726 PIECES

Mt. Vernon, Washington's old homestead, built in miniature by Earl D. Newitt, of DeRuyter, N. Y. on a scale of 1 in. equals 6 ft. Wood, cardboard, and paper are the principal materials. The work took 475 hours, and 3,726 pieces are used. The roof contains 2,110 shingles of cardboard; the chimneys are in-aid with 280 pieces; the railing over the veranda is made of toothpicks and contains 497 pieces

ULTRAMODERN CAR

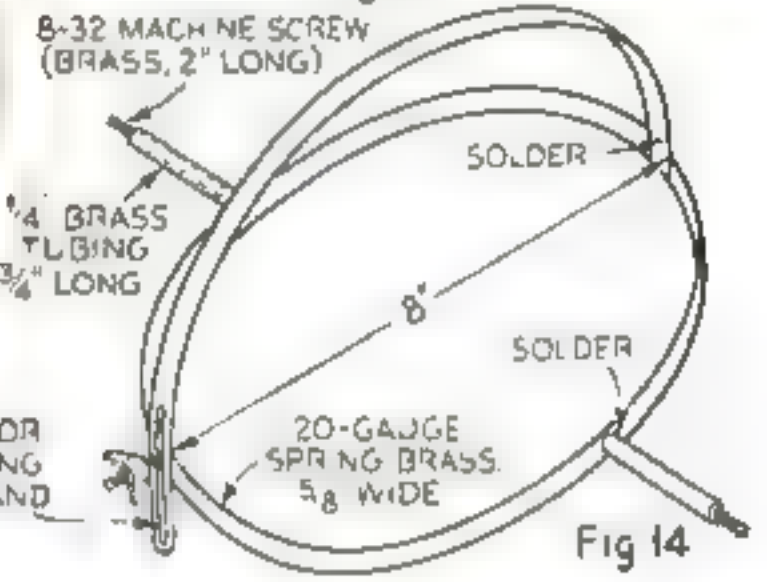
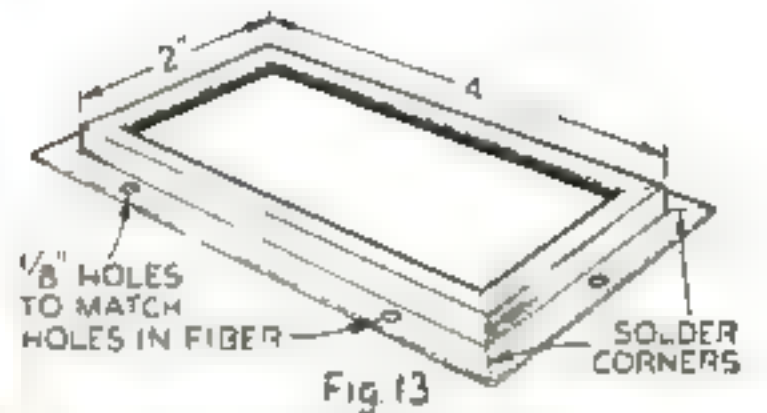
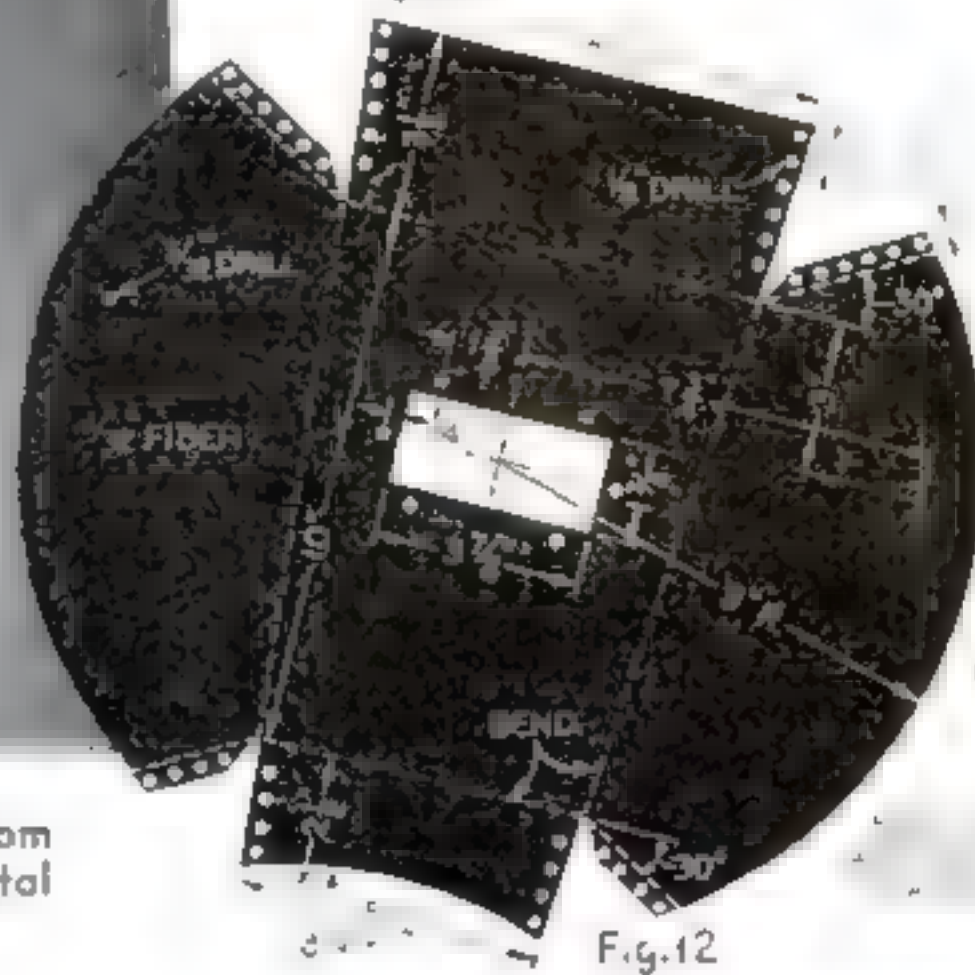
Car built by Len L. Sailer, of Boone, Iowa. It seats two in tandem, weighs 2,600 lb., has all airplane instruments, and is sound-proofed. Up to 50 miles, the six-cylinder motor operates on an up-draft carburetor, then a down-draft carburetor cuts in. The body is of rustless steel



Welding Rod Holder and Mask



A good mask is essential. It protects the welder's eyes from ultraviolet rays and his face from particles of molten metal



BEFORE the homemade arc welder described in the two preceding articles of this series* can be put into operation, it is necessary to make a holder for welding rods and a mask.

Holder. Obtain round brass rod, $\frac{1}{2}$ by 15 in. Cut a piece 1 in. long for the end piece (Fig. 10) and drill as shown to hold welding rods up to $\frac{1}{4}$ in. in diameter. If it is desired to use larger carbon rods, provide an additional end piece.

Cut down one end of the remaining brass rod to a diameter of $\frac{1}{4}$ in. for a distance of 1 in. and thread as indicated. The threaded portion should be tapered at the end so that it will screw into the end piece and reach the farther side of the $\frac{1}{4}$ -in. hole. File the opposite end of the long rod flat, and drill and tap for a machine screw to hold the lug of the cable.

Provide a wooden handle with a $\frac{1}{2}$ -in. hole through the center, and add a fiber or asbestos-board guard. A piece of regular welding cable should be obtained to connect the rod holder with the

By
KENDALL FORD

transformer as it is more flexible.

Connecting Lug for Work. Drill and shape the lug from round copper rod $\frac{1}{2}$ by 3 in. as in Fig. 11. The side to be clamped next to the part being welded should be filed perfectly flat to insure a good contact. Solder rubber-covered flexible wire not smaller than No. 4 in the lug to connect with the transformer.

Mask. The operator's eyes and face must be protected. This point cannot be too strongly emphasized. The ordinary colored glasses such as are used for oxy-acetylene welding are worthless in preventing the harmful ultraviolet arc-welding rays from injuring the eyes. The mask also protects the face from the molten particles of metal that are continually flying from the arc.

Obtain $\frac{1}{32}$ -in. thick fiber, 16 by 18 in., and cut and drill as in Fig. 12. Bend along the dotted lines, but not sharply or the fiber is apt to crack. Rivet or bolt at the corners. The special glass,



Rear view of the mask, showing glass frame and headband. The drawings are given above

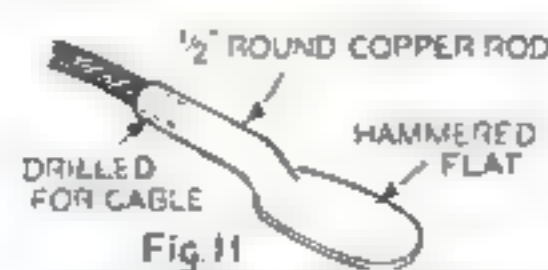
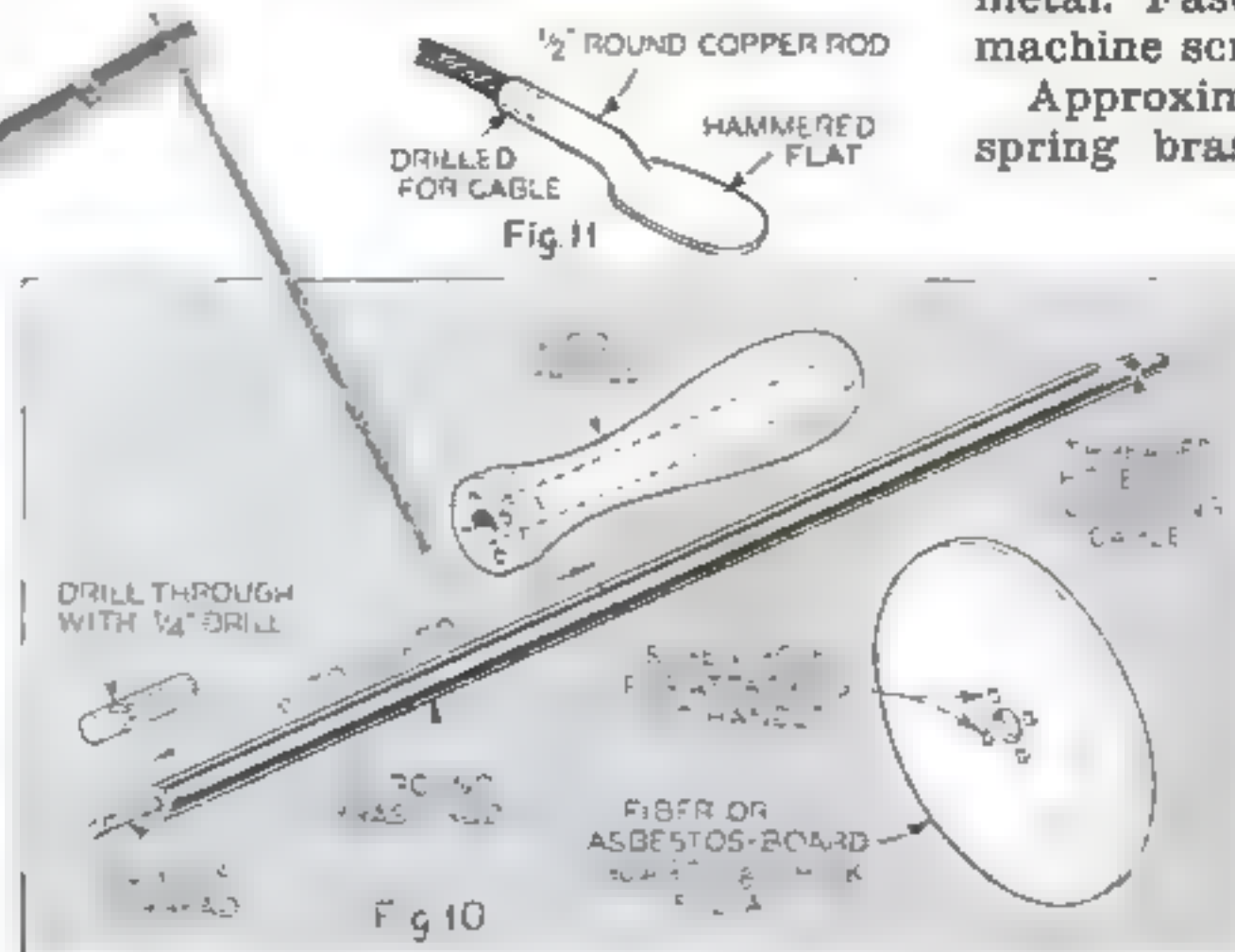
2 by 4 in., may be obtained from dealers in welding supplies. Place a piece of clear glass on each side of the colored glass. The outside piece will become pitted and will have to be replaced occasionally. A glass-holding frame may be made as in Fig. 13 from 20-gauge metal. Fasten it to the fiber with small machine screws.

Approximately $3\frac{1}{2}$ ft. of 20-gauge spring brass $\frac{5}{8}$ in. wide will be required for the headband (Fig. 14). The mask is slipped on the extended machine screws on the headband and held with knurled or wing nuts. This arrangement enables the mask to be swung upward for inspecting work. Before the headband is fastened to the mask, wrap it with several layers of cotton tape to pad any sharp edges.

(Continued on page 114)



Homemade rod holder for arc welding and, at right, details of the parts. In actual use, the hand must, of course, be protected by a heavy gauntlet of leather



Helpful Hints for Motorists

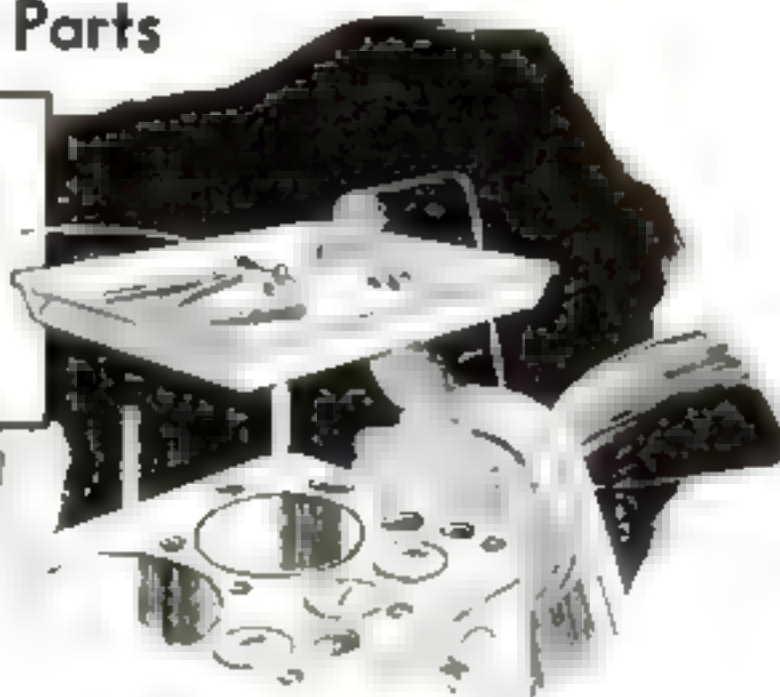
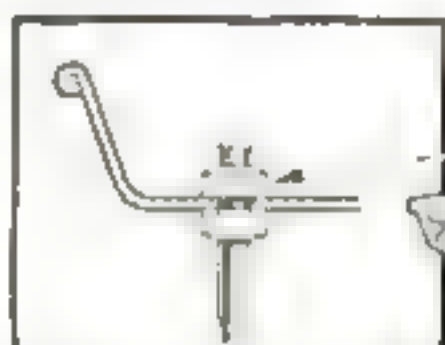
Child's Roller Skate Aids In Changing Heavy Tires



TO LIGHTEN the task of changing a heavy tire, one truck driver carries an ordinary roller skate in his tool kit, and uses it as shown at the left. The skate supports the weight of the tire, leaving him free to slide the spare wheel in place. I've used the same kink when changing tires on my car and find that it eliminates lifting the heavy wheel.—A. H. W.

Handy Repair Rack Prevents Loss of Parts

A RACK that will keep small engine parts and repair tools in order without danger of being upset can be easily made from a shallow baking pan, a short threaded rod, and two nuts. The rod should be of the same diameter and thread size as the studs, so that it can be screwed into the cylinder block. The baking pan, preferably of the heavy sheet-metal type, is clamped between the two nuts as shown.—H. W.



This instrument panel mounted under the hood makes electrical adjustments easy



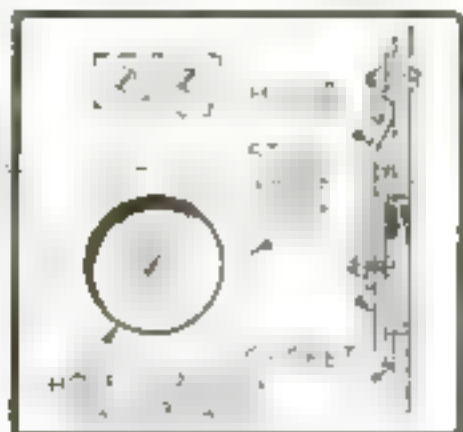
Car's Electric System Checked With Auxiliary Meter Panel

THE man who likes to make his own adjustments to the electrical system of his car will find it worth while to install a voltmeter and ammeter permanently on the engine side of the dash, as shown in the photographs above. This makes it easy to note the effect of each adjustment while the work is being done. The ammeter is connected across the battery terminal of the generator cut-out and the ground (chassis), and indicates the total generator current, including that used by the ignition system. Thus its reading is higher than that of the car's regular ammeter. The generator can be set to the exact charging rate desired by watching this meter while the third brush is shifted. The voltmeter is wired in series with a push button, and connected between the battery lead and the ground. It shows the voltage of both battery and generator.—A. C. C.

Flap Valve Makes Car Doors Close Easily

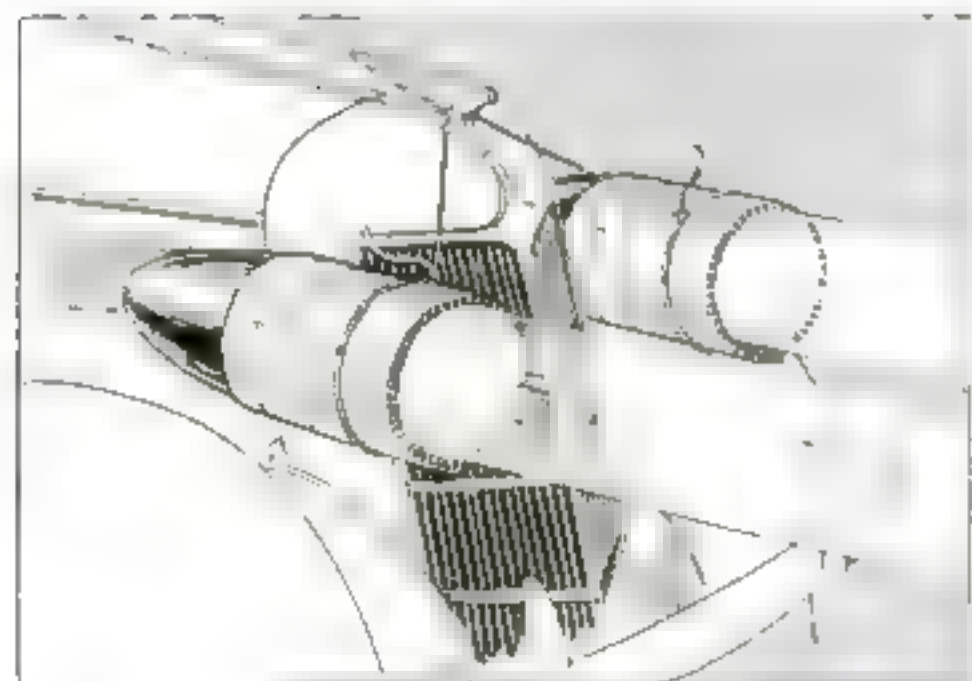


The flap valve, and how it is installed



MANY owners of new, steel-roofed cars experience trouble with doors that are hard to close because of air trapped within the rigid body—in fabric-topped cars, the roof yields enough to relieve this pressure. The trouble can be eliminated by installing the simple flap valve illustrated. It consists merely of a hinge and a paper-faced metal disk, and is most conveniently located in the dash.—E. T. G.

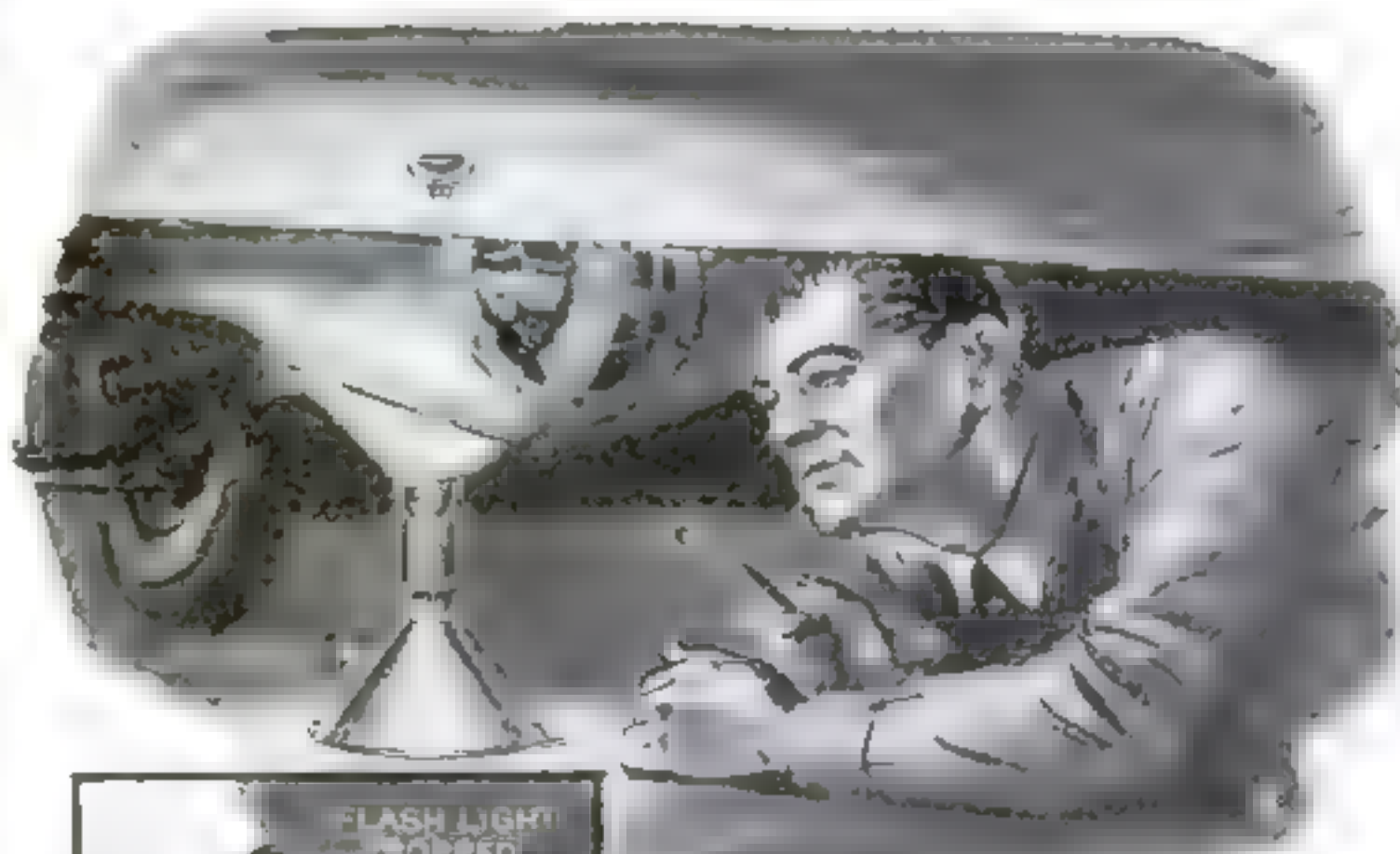
Funnel and Pliers Form Handy Flash-Light Holders



Emergency Fog Lights Made from Cardboard Tubing

Fog and darkness are a particularly bad combination of driving conditions because the headlight beams are reflected back into the driver's eyes. This glare can be partially eliminated, however, by making a pair of cardboard tubes and fastening one to each lamp, bracing them with string. The tubes direct the light on the road, and extend the range of vision considerably.—R. T. T.

For directing the beam of a flash light just where it is needed, an emergency support can be made by gripping the barrel of the light in a pair of pliers, and slipping a rubber band over the handles. For work under the car, a permanent holder can be made from a large funnel. Cut the neck down to about one inch in length, and make several lengthwise slits in the remaining collar. The torch is gripped firmly by the metal tabs, as shown, and the wide base prevents upsetting.—G. E. H.



For chassis work, the holder above will direct the light where it is wanted. The plier arrangement at the left is fine for tire repairs

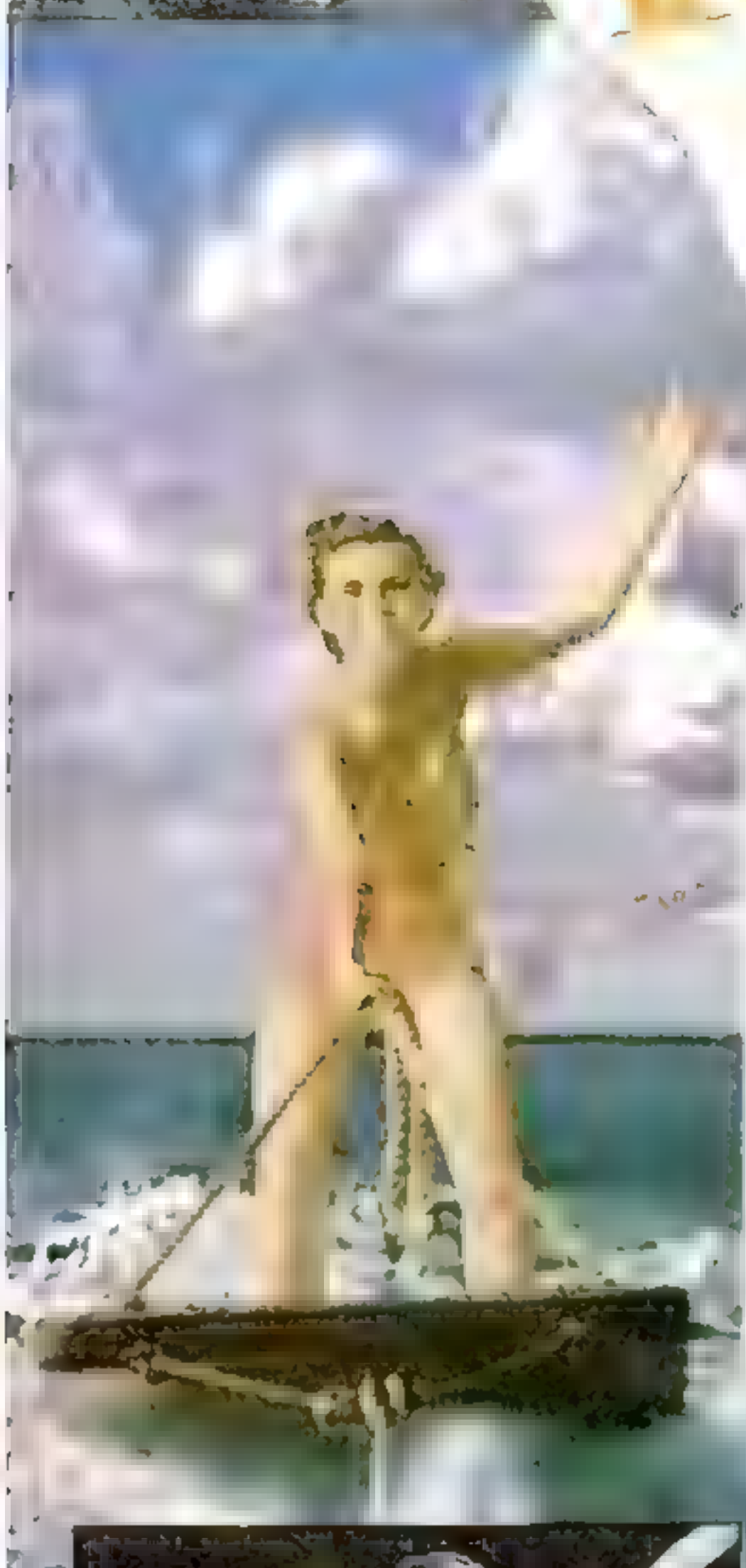


SURE IT IS

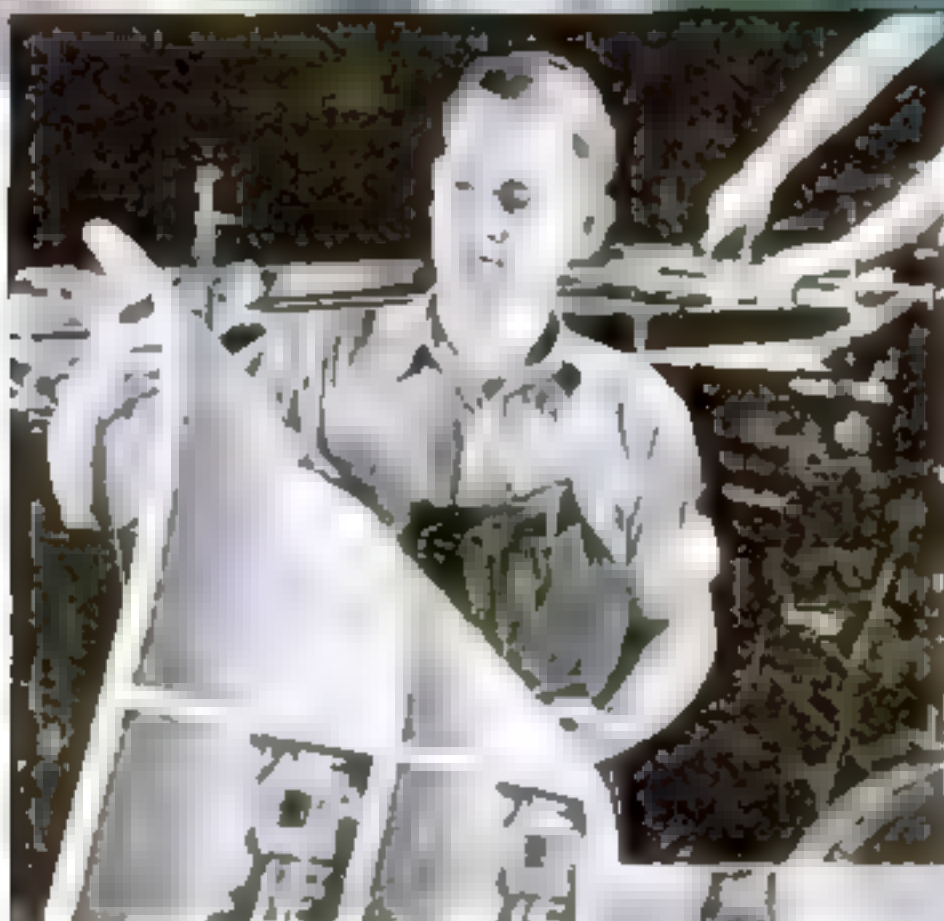
—and mighty strenuous too!

"SPORT, even for the fun of it, can be tense and tiring," says Miss Gloria Wheeden, who shows her skill at aquaplaning above and at the left. "Like most of the folks who go in for water sports, I pride myself on my fine physical condition. Yes, I smoke. When I feel a bit let-down, I light up a Camel and get an invigorating 'lift' in energy."

Miss Wheeden's enjoyment of a lift from Camels is shared by famous champions in many sports, and by millions of other men and women in all walks of life. When an active day drains physical and nervous energy, Camels help you renew your flow of vim. And being mild, they never get on your nerves.



Copyright, 1937, R. J. Reynolds Tobacco Company, Winston-Salem, N. C.



"MANY A TIME I've smoked a Camel to get a 'lift,'" says Harry Burmester, printer (left). "With Camels handy, I feel I can take the tough spots right in stride. Camels never tire my taste or irritate my throat—even smoking as much as I do."

1060 PARACHUTE JUMPS—no mishaps! Floyd Stimson (right) started smoking Camels 10 years ago—at the time he made his first parachute jump. "Camels are so mild, I take healthy nerves for granted," says Floyd. "I've found what I want in Camels—mildness and tastiness."



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Camels are made from finer, MORE EXPENSIVE TOBACCOS... Turkish and Domestic... than any other popular brand

Get a Lift with a Camel!

Sports Photography

THREE TRICKS OF TAKING ACTION SNAPS WITH AN ORDINARY CAMERA

By
EMILE ALETTI



Action snapped at 1/30 second. The secret lies in keeping at a distance—in this case, 60 ft.



YOUR camera may be of a very inexpensive and ordinary type, but that's no reason why you can't take good sports and action photos. Even those cameras with only one snapshot speed are quite capable of giving satisfactory results if you know the various tricks of sports photography.

The accompanying illustrations show what can be done. Most of them were taken at 1/30 second with a three-dollar camera.

Catching the action when it is stopped—that's the first secret to learn. It is one of three principal ways in which we take sports snapshots, and the easiest to understand and use.

Did you ever stop to think that some of the most dramatic moments occur when there is no motion at all? Let's take a tennis player about to serve. His racket is drawn back and his face is contorted with effort, but his body has very little motion. Watch a baseball player about to hit the ball. The bat is drawn back, and the player's face is eloquent of energy. Again we have action without motion.

This moment of arrested motion is duplicated many times in sports: the diver at the top of his leap; the golfer at the top of his swing, either before or after he has hit the ball; the sprinters at their marks as the gun goes off; the football player at the top of his kick, and many others. These are the instants when you can get your picture.

Let me warn you, however, that you must expect some failures, especially at first. You cannot hope to snap every

Action without motion:
10 ft., 1/25 second



picture perfectly. It takes patience and experience to be able to anticipate and catch the lull that you are waiting for.

A knowledge of the game helps a lot here. If you can anticipate from the way the game is going that there will be an attempt to steal third, then you can get set and catch the runner at the moment he stops his slide in a cloud of dust.

There is another important thing to remember: Get as close to your picture as you can. A large image is a lot more satisfying than a tiny picture taken a hundred feet from the action.

Some games, of course, seem to have no moments of suspended action, such as soccer, lacrosse, and polo. How are we going to get pictures of these sports? Again, suppose we want to take sprinters at the tape or hurdlers going over the timber? Here we have to use our second method.

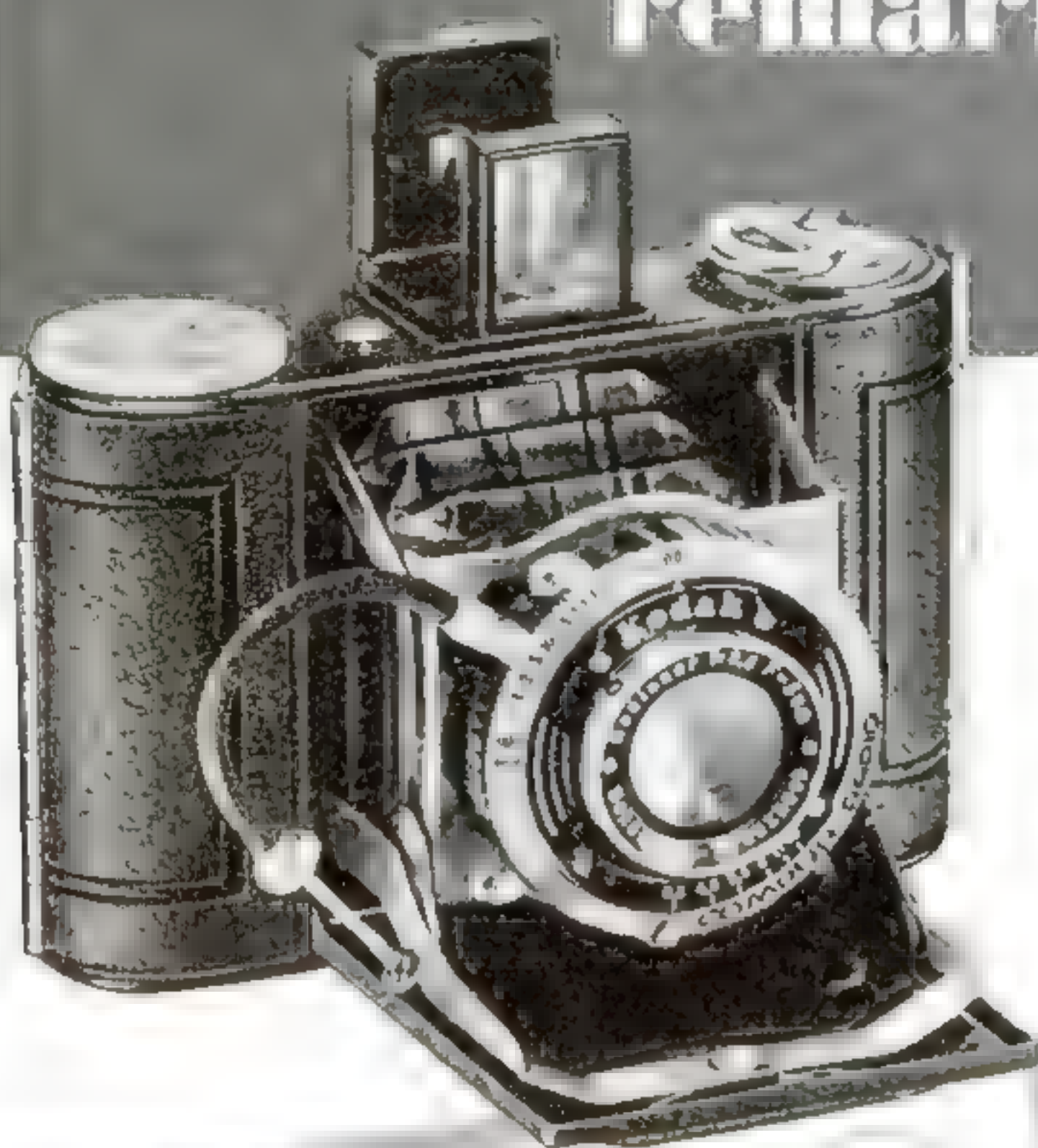
In the case of runners at the tape, stand about forty feet from the tape at the side of the track and take the picture from there. The same procedure applies whenever the athlete is running towards (or away from) the camera. Wait until the runner is forty feet away, then snap him.

Now, you may follow these instructions and find that your picture is blurred. This indicates that you were too close for the shutter speed of your camera. The exact distance for any particular
(Continued on page 116)

Below, soccer players moving toward camera, taken at 20 ft., 1/30 second



Full-range "miniature" at a remarkably low price...\$44.50



LENS . . .

Anastigmat f.3.5. You get sharp negatives in clear or cloudy weather and indoors at night under Photoshoots.

SHUTTER . . .

Rim-set Compur-Rapid, with 9 speeds up to 1/500 second for fast action—down to a full second for difficult light conditions.

REVOLVING LENS MOUNT

Graduated to permit quick, easy, accurate focusing of the camera at distances from 3½ feet to infinity.



YOU GET 16 PICTURES ON AN 8-EXPOSURE ROLL



Kodak Vollenda gives you 16 pictures, each 1 1/16 x 1 9/16 inches, on a roll of Kodak film No. 127: Verichrome, 25¢; "SS" or Panatomic, 30¢.

Hinged back makes loading easy. Ruby windows have safety device; no need for covers when using fast film.

For negatives capable of extreme enlargement, Kodak Panatomic Film is especially recommended.

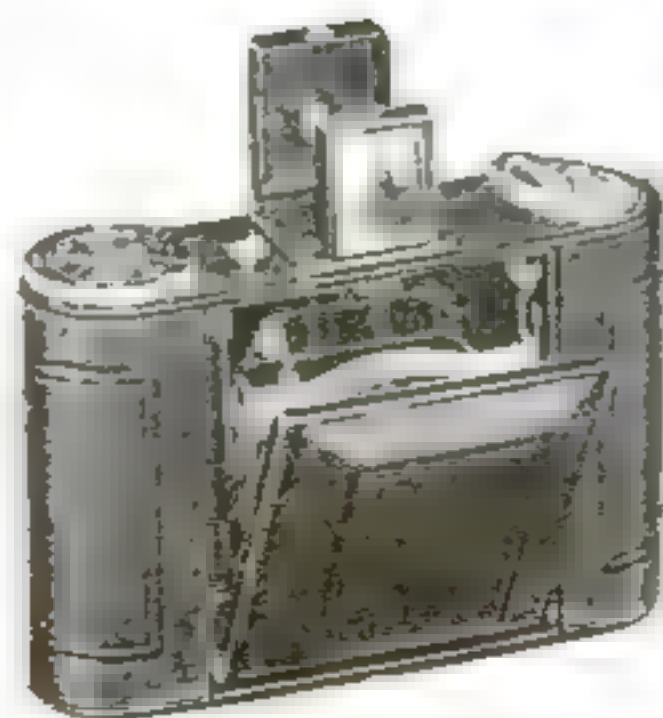
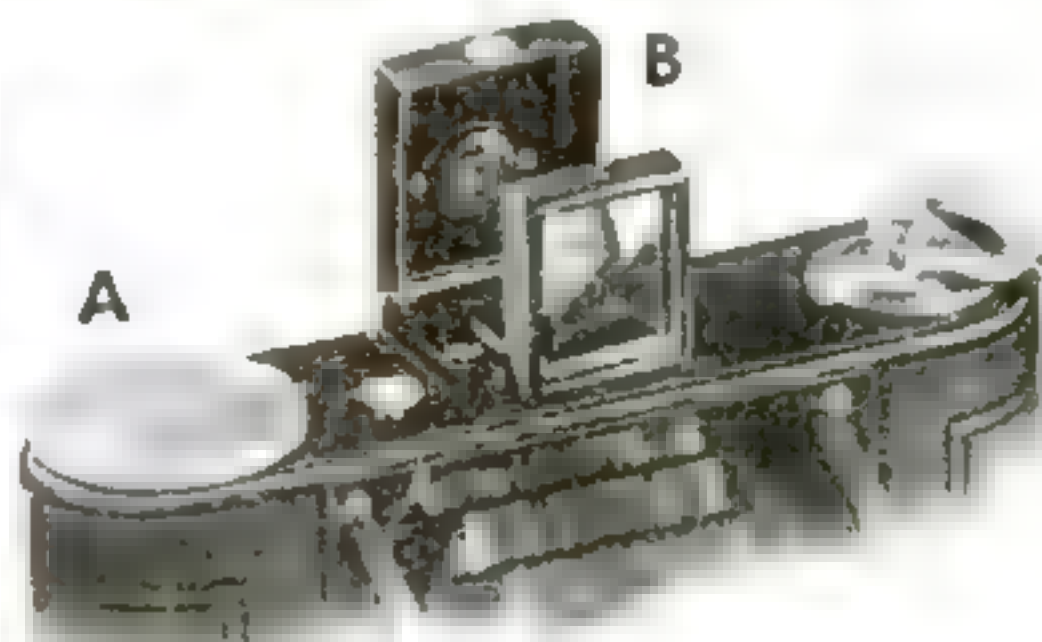
KODAK VOLLEND A in hand, you're ready for every picture that comes along—"now-or-never" off-guard snaps, lightning-fast sport shots, landscapes, close-ups, rainy-day pictures, indoor snapshots under Photoshoots.

The brilliant f.3.5 anastigmat lens—the Compur-Rapid shutter with nine speeds up to 1/500 second—explain Kodak Vollenda's unusually wide picture-taking range. Negatives are critically sharp, and capable of extreme enlargement—especially when Kodak Panatomic Film has been used.

Ask your dealer to show you Kodak Vollenda and the pictures it takes. Weigh its wide range and advanced refinements against the low price—\$44.50—and you're pretty sure to agree that in the "miniature" field, the Vollenda is the buy... Eastman Kodak Co., Rochester, N. Y.

ONLY EASTMAN MAKES THE KODAK

DEPTH-OF-FOCUS SCALE (A) Rotating outer ring shows sharp-focus range for any stop-and-distance combination. **FINDER (B)** The direct-view, eye-level type; folds flat when the camera is not in use.



ACTION FRONT

Actuated by push button, automatically opens camera, extends bellows, erects lens, and locks front firmly in correct picture-making position.

KODAK VOLLEND A

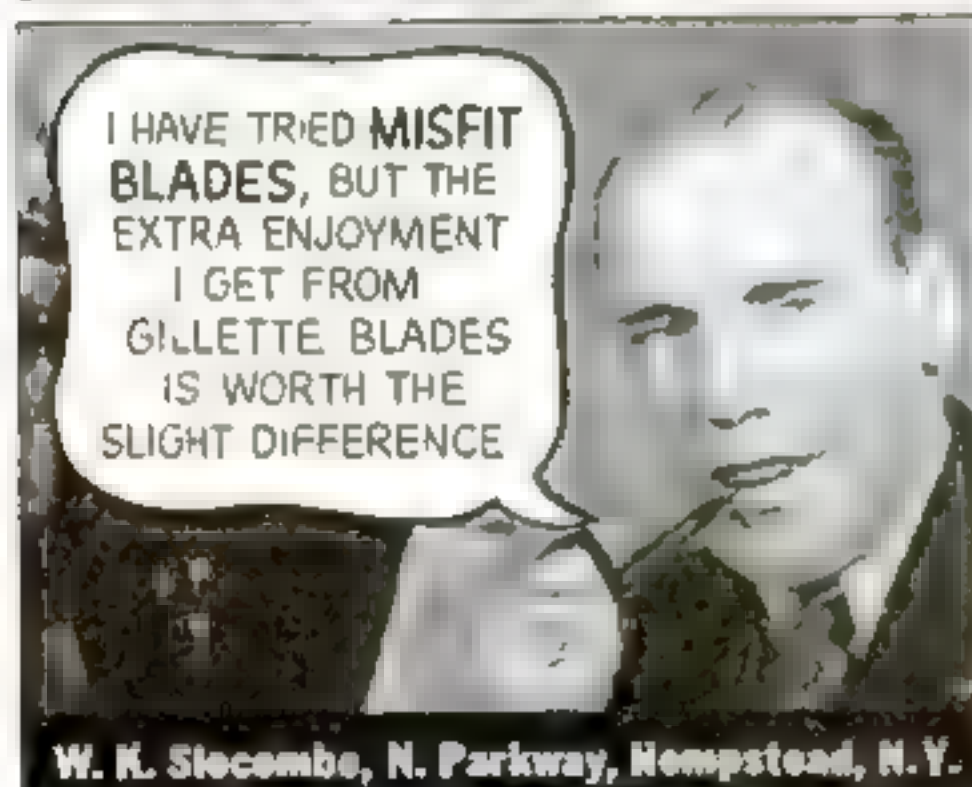
"Misfit Blades Nicked My Face Scraped My Skin

—says Illinois man

Now I'm back to Gillette Blades
in my Gillette Razor."



W. R. Corbett, Quintons Road, Palatine, Ill.



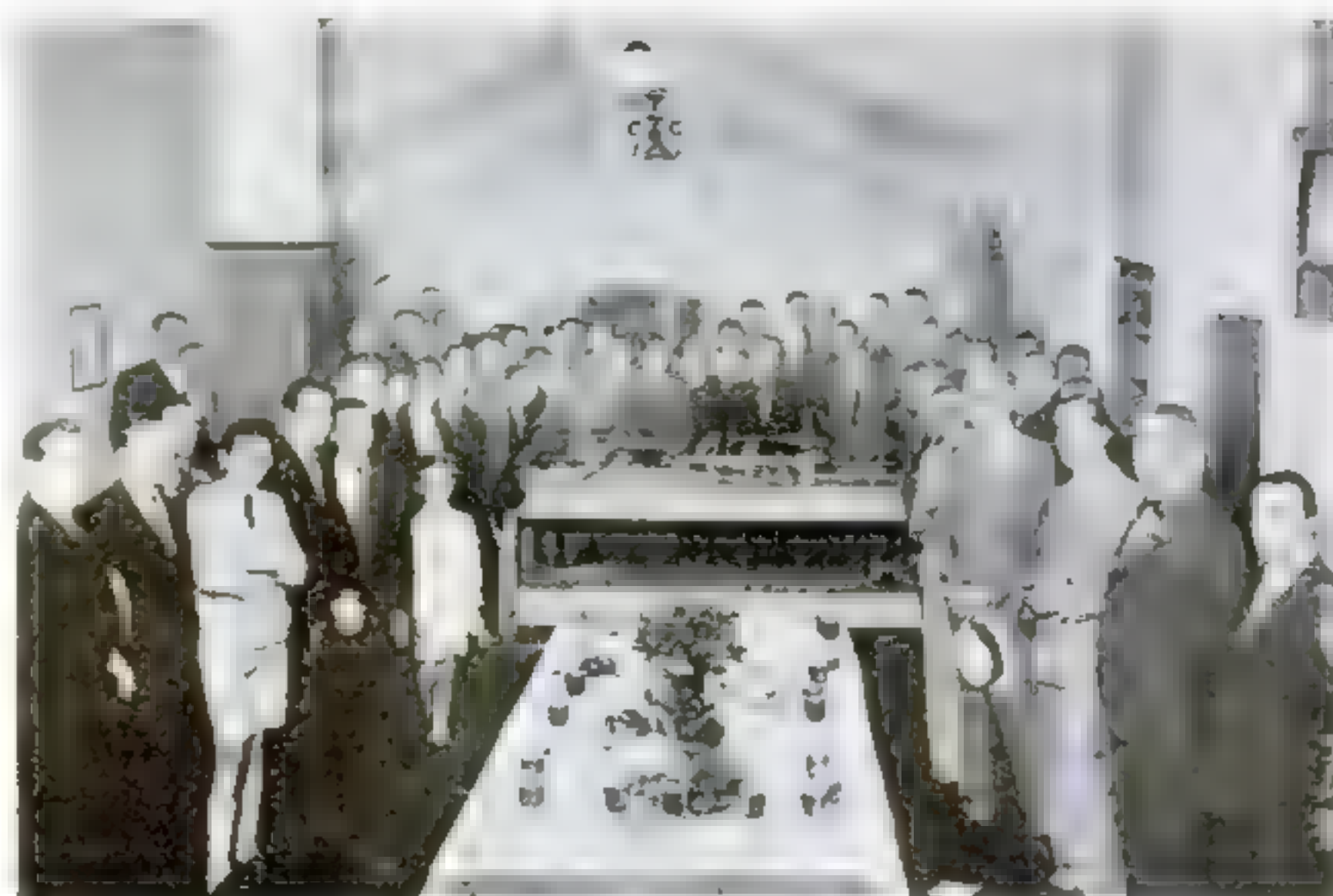
W. K. Stecombe, N. Parkway, Hempstead, N.Y.

Millions Are Switching Back —to Gillette "teamwork" shave

THE trouble with using MISFIT blades is that the shaving edges may not be properly exposed in the razor. Too much shaving edge is likely to scrape your face. Not enough shaving edge leaves your face half shaved. But why risk these discomforts when you can avoid them by always using Gillette Blades in your Gillette Razor. These two are made for each other. Designed by the same engineers, they are matched as perfectly as the parts of a fine watch. Buy Gillette Blades for your Gillette Razor today.



Gillette Blades
Precision-made for the Gillette Razor



Members of a club organized in Buenos Aires, Argentina, along lines suggested by the National Homeworkshop Guild. There are now several large foreign clubs

Guild Craftwork on Display

(Continued from page 95)

Recent programs of the *Great Falls (Mont.)* Homeworkshop Club have included the making of an inlaid picture, a demonstration on metal turning lathes, and a talk on laying gold leaf. The members are entering a number of pieces in a hobby show sponsored by the local recreation association.

Paul Denis, secretary of the *Cartier Homeworkshop Club, Montreal, P.Q., Canada*, is making a model of a famous locomotive, and Georges Frenette is building a model warship from plans drawn by Mr. Denis. . . Members of the *Mansfield (Mo.)* Homeworkshop Club have discovered that the tables used for pin-ball games can easily be made into attractive tables for the home. The tables can be obtained very cheaply since laws were passed forbidding the playing of such games. . . A demonstration on the use of plastics was given at a meeting of the *Oklahoma City (Okla.)* Homeworkshop Club. Another meeting was devoted to a discussion of shop problems. . . Benjamin Burbank gave a demonstration of homemade sanding disks and grinding wheels for a recent meeting of the *Brunswick (Me.)* Homeworkshop Club held at the Searles Science Building.

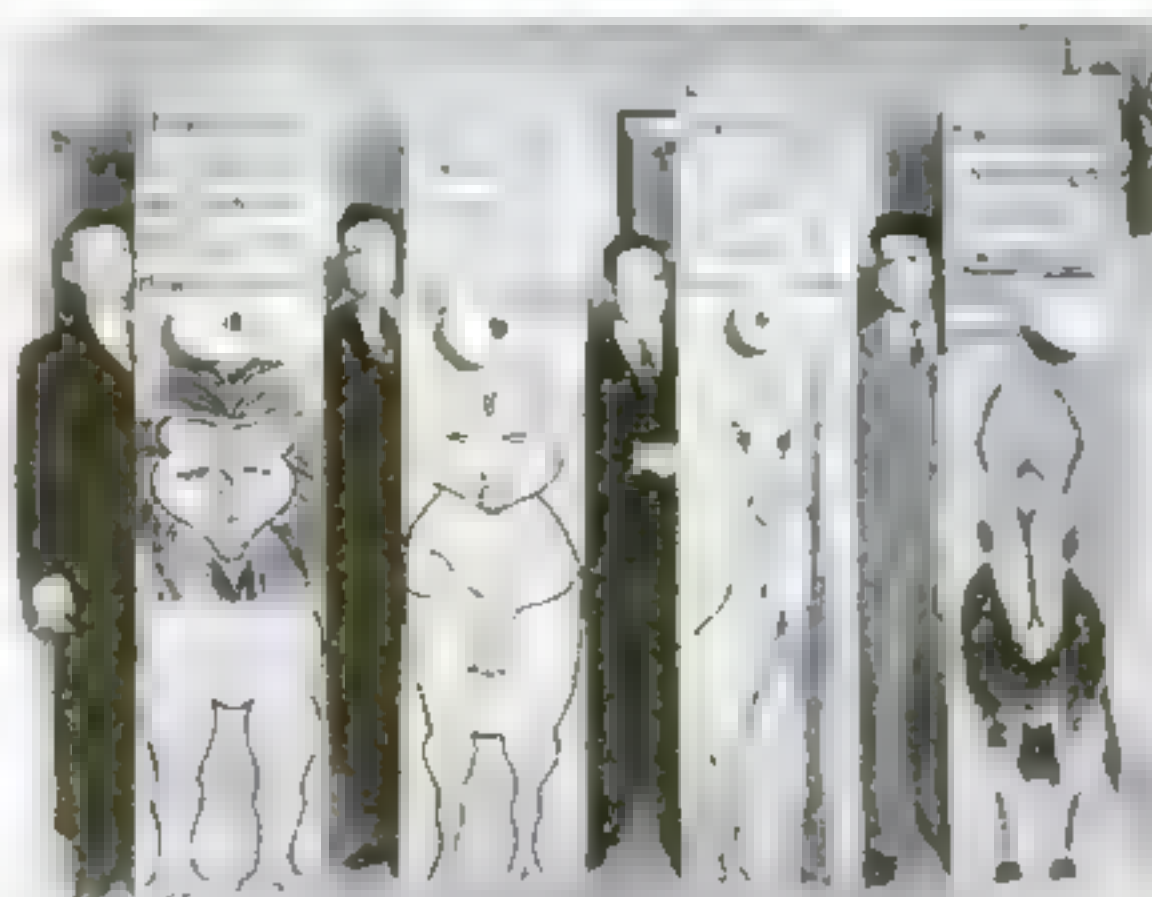
New officers of the *Freeport (N.Y.)* Craftsman's Guild are Gilbert Flint, president; Theodore Congdon, vice president; Bruce Cook, secretary-treasurer; Lloyd Hansen, librarian. On the board of governors are Frank Filkins, Charles Stumpf, and Paul Georgi.

A demonstration of the use of Keene's cement was given by Don L. Olson at a recent meeting of the *Dawson (Minn.)* Homesteaders Club. Mr. Olson turned a bowl and several trays on a lathe. Industrial sound and silent moving pictures have been shown with the new projector owned by the high school, where meetings are held. Among the projects displayed at the annual exhibition the end of May were floor and bridge lamps, sewing baskets, table lamps, end tables, book ends of wood and copper, and other wood and metal articles.

Metal spinning and the use of spinning tools were demonstrated by the manual training instructor at Benton High School for the *St. Joseph (Mo.)* Homeworkshop Club. Also included in the evening's program were displays of Indian beadwork, leathercraft, archery, and woodcraft. The meeting was arranged by B. O. Willhite, and students of the manual training class greeted members at the door and directed them to the proper room.

William Howard Galbraith was host to the Capital Homestead Club of *Washington, D.C.*, and gave a short talk on wood finishing, illustrated with sketches. Reid K. Middleton demonstrated the application of woodworking to foundry practice and described how to make a pattern. David and Jack Porterfield were hosts to the club at another meeting.

New officers of the *Ashtabula (Ohio)* Homeworkshop Club are Richard Pearson, president; Emil Nelson, vice president; Carl Zehr, secretary; E. A. Olson, treasurer; John Hoyt, librarian. Recent programs have included demonstrations of violin making, metal spinning, poultry—(Continued on page 109)



Amusing megaphone placards made by members of the *Newcastle (Calif.)* Club for use as a playlet novelty

Craftwork on Display

(Continued from page 108)

disease diagnosis, soldering, welding, and furniture finishing.

During the past year the Massachusetts Model Railroad Society, Inc., Boston, Mass., has grown from thirty to eighty members. A new clubroom has been leased and at present the members are building a new layout, which consists of a double-track main line with a single track mountain division having stations, bridges, yards, roundhouse, and turntable in "O" gauge; also a single-track line with yards and equipment in "HO" gauge, and a loop in "OO" gauge. The club's workshop consists of a workbench, metal-turning lathe, drill, and various small tools necessary for metal working. Lester D. Friend is president; Howard E. Paulson, vice president; Wilfred L. Hurley, secretary; Ralph A. Barrows, treasurer; Stanley M. Hauck, librarian. On the board of directors are John Borges, Herbert O. Harris, and Sidney Jagger.

Molding in a home foundry was demonstrated to the Tri City Homeworkshop Club of LaSalle, Peru, and Oglesby, Ill. A picnic was held early in June . . . Two members of the Oneonta (N.Y.) Homeworkshop Club are building band saws and another is making a drill press. An elaborate toy-building program is planned for next fall; also an exhibition. . . . After attending a recent exhibition, the Passaic County Homeworkshop Club of Hawthorne, N.J., arranged to visit some of the members' workshops of the Wood-Ridge (N.J.) Homeworkshop Club. As a result, the Hawthorne group is planning its own exhibition . . . The Newcastle (Calif.) Homeworkshop Club held a successful exhibition in a store.

The Dover (N.H.) Homecraft Club recently enjoyed a month crammed with instructive talks and demonstrations. Professor Clark Stevens of the University of New Hampshire explained methods of identifying different species of wood and showed lantern slides; moving pictures on the manufacture of steel were shown at a second meeting; Arthur Cram, Jr., displayed anvils and hammers for making copper dishes, and Daniel Flint told about a trip through a glue factory at Gloucester, Mass., at the third meeting. An illustrated lecture on methods of framing stairways was given at the fourth meeting by Professor L. J. Batchelder.

A contest is being sponsored by the Covington (Ky.) Homeworkshop Guild, the work being divided into three classes: items having a value less than \$5, between \$5 and \$15, and over \$15. Some very original and practical projects have already been started. Charles Zimmer, Jr., has been named publicity chairman . . . Courses in four subjects—photography, leathercraft, weaving, and wood-working—are being conducted by the Cabway Lingo Homeworkshop Guild, Missouri Branch, W. Va. . . . In order to demonstrate the use of a bench saw, planer, and drill press, Alfred Munick built a foot stool for the South Shore Homeworkshop Club of Quincy, Mass.

How to Start a Club

COMPLETE information on how to organize a home workshop club is yours for the asking. Address the National Homeworkshop Guild, 347 Fourth Avenue, New York, and inclose a large (legal size), self-addressed envelope bearing a three-cent stamp.



9
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of Taste

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1. Fine old Kentucky Burley aged-in-wood.
2. Flavored with pure maple sugar for extra good taste.
3. An altogether different fragrance.
4. Cut to pack easy in a pipe—cut to roll smooth in a cigarette.
5. Every tin contains 2 full ounces.

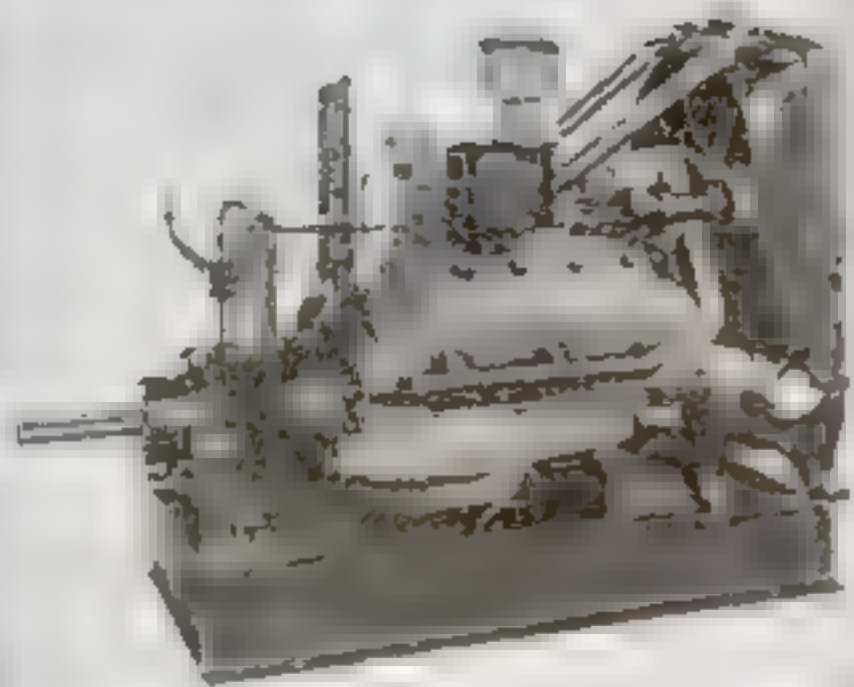
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Smoking
Tobacco

for pipe
or cigarette



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for Building a RACING SAILBOAT

IF YOU begin work at once, there is still time to build our new racing sailboat *Blackcat* and enjoy it before the boating season is over. The boat is 13 ft. 4 in. long, 5 ft. wide, will carry three passengers, weighs 250 pounds, and costs approximately \$75 to construct, including all fittings and a purchased sail. The price of the complete set of blueprints (Nos. 321-322-323) is 75 cents, and for \$1.50 additional full-size patterns of the frames and other important parts will be drawn to order.

Many other blueprints for boats, as well as ship models, radio sets, furniture, and novelties, are available. Some of them are listed below, but it is best to send a stamped, self-addressed envelope for the complete list.



BOATS

Canoe, 16-ft. Canvas-Covered Kayak, with sail, etc., 192-193-194-R	1.00
Camper's Utility Boat (11 ft. 2 in. long, canvas-covered, for outboard motor or rowing), 281-R	.50
Canvas-Covered Duck Boat (13 ft. 6 in. long), 279-R	.50
Folding Duck Boat (13 ft. long), 170-R	.50
High-Speed Boat for Small Outboard Motors (7 ft. 11 in. long), 257-R	.50
16-ft. Motorboat-Rowboat (has decked hull; for use with outboard or inboard drives and oars), 149-R	.50
Outboard Racer for Class "A" and "B" Motors, (10 ft. 4 in. long), 211-212-R	.75
Racing Runabout (13 ft. long, for outboard motor), 261-262-R	.75
Racing Sailboat <i>Blackcat</i> (13 ft. 4 in. long, 5 ft. beam, weighs 250 lb., Marconi rigged), 321-322-323	.75
Sailboat (12 ft. long; weighs 200 lb.; has fast skimming-dish hull), 314-R	.50
Sport Runabout (9 ft. 8 in. long, 43-in. beam, for small outboard motors), 309-310-R	.75
Utility Rowboat, 13-ft., (can also be sailed or driven by outboard motor), 224-R	.50



RADIO SETS

All-Wave Portable Receiver (two tubes, operated by battery), 217-R	.50
Amateur Short Wave Receiver, 155	.25
Amateur Radio Transmitter, 183-184	.50
Five-Tube Short Wave (A.C. or D.C.), 223	.25
Full Electric Headphone Set, 130	.25
One Tube (battery operated), 103	.25
Screen-Grid Set, 109	.25
Short-Wave Converter Unit, 137	.25



MODELS

<i>Aquitanza</i> , liner (9 in.), 225	.25
<i>Bluenose</i> , famous fishing schooner, 17½-in. hull, 110-111-112-R	1.00
Brig <i>Malek Adhel</i> (20-in. hull; frame-and-plank construction), 304-305-306-R	1.25
Clipper Ship <i>Great Republic</i> (31½-in. hull), 272-273-274-R	1.25
Coast Guard Patrol Boat (20½ in.), 286-287-R	.75
<i>Constitution</i> ("Old Ironsides"), 21-in. hull, 57-58-59-R	1.00
Covered Wagon (23½ in.), 118-119-120-R	1.00
Cruiser U.S.S. <i>Indianapolis</i> (12 in.), 216	.25
Farragut's Flagship <i>Hartford</i> (33½-in. hull), 221-222-R	1.50
Felucca or Barbary Pirate Galley (20 in.), 44-45-R	.75
Freighter, Ocean (14-in.), 271	.25
H. M. S. <i>Bounty</i> (8½-in. hull), 254	.25
Liner <i>Normandie</i> (20½-in. hull), 264-265	.50
Liner <i>St. Louis</i> (11-in.), 231	.25
Racing Yacht <i>Seascout</i> (42-in.), 106-107-R	.75
Roman Galley (19-in.), 138-139-R	.75
Ship Model Weather Vane, 66	.25
Stagecoach with Horses, 144-145-146-R	1.00
Trading Schooner (17½-in. hull), 252-253	.50
Tugboat, Harbor (11½-in.), 284	.25
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{Construction kits are available for some of these models. See page 15.}



FURNITURE

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353 Fourth Avenue, New York

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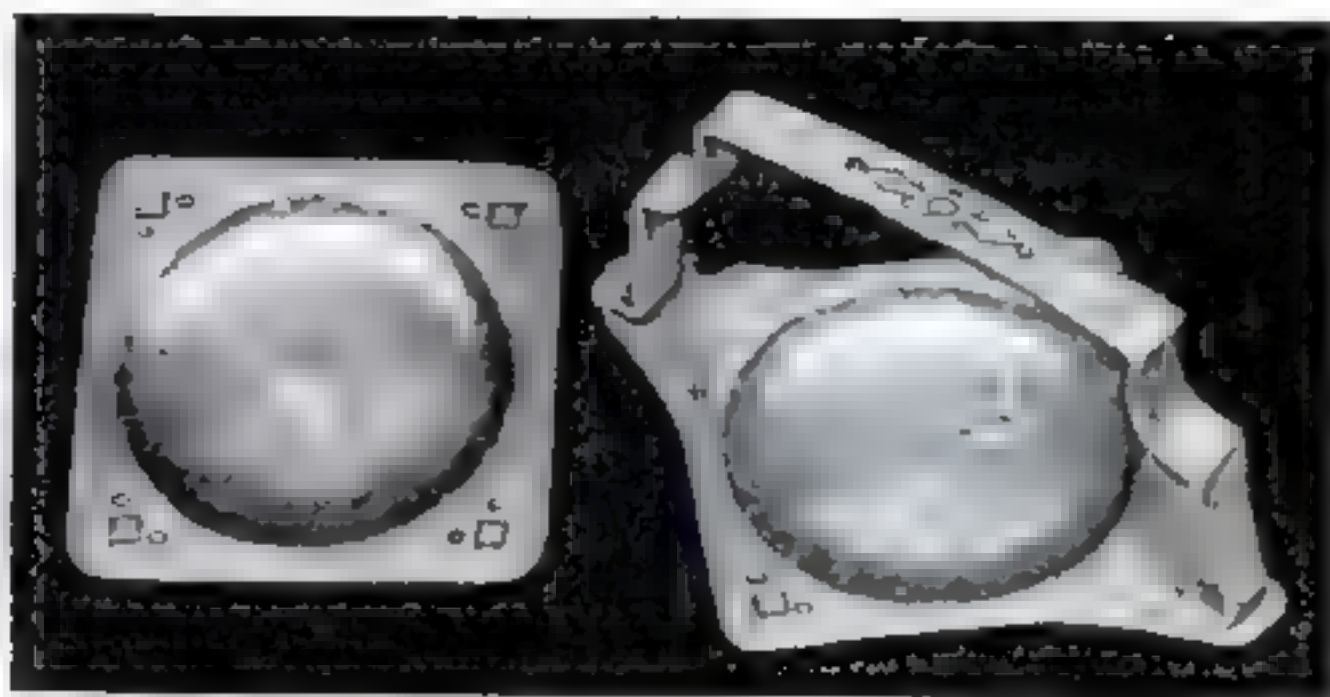
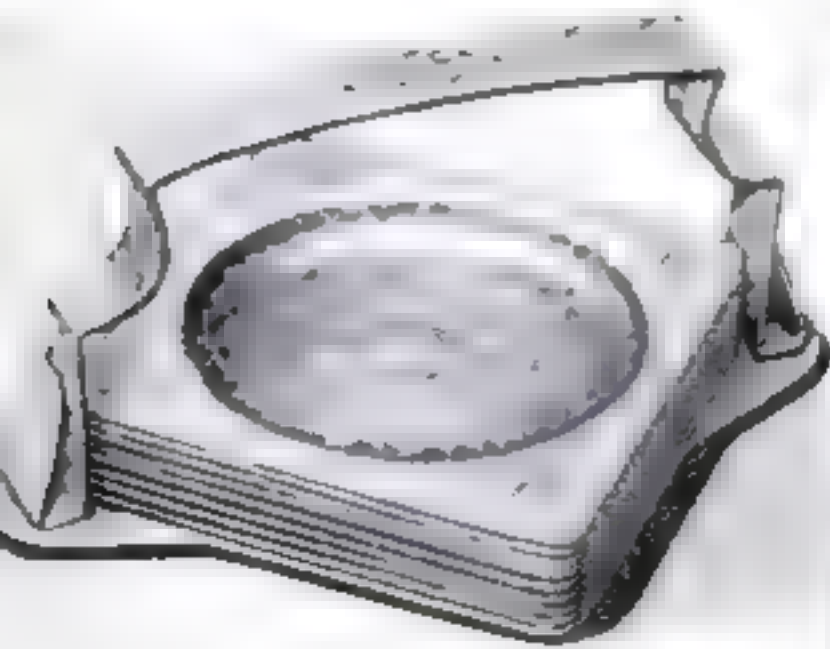
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Hammered Aluminum Coasters



Completed coasters. At right, how the margin is flattened

HAMMERED aluminum is now so popular that more amateur craftsmen should try using this soft, easily worked metal. A good project to start with is the nest of coasters illustrated.

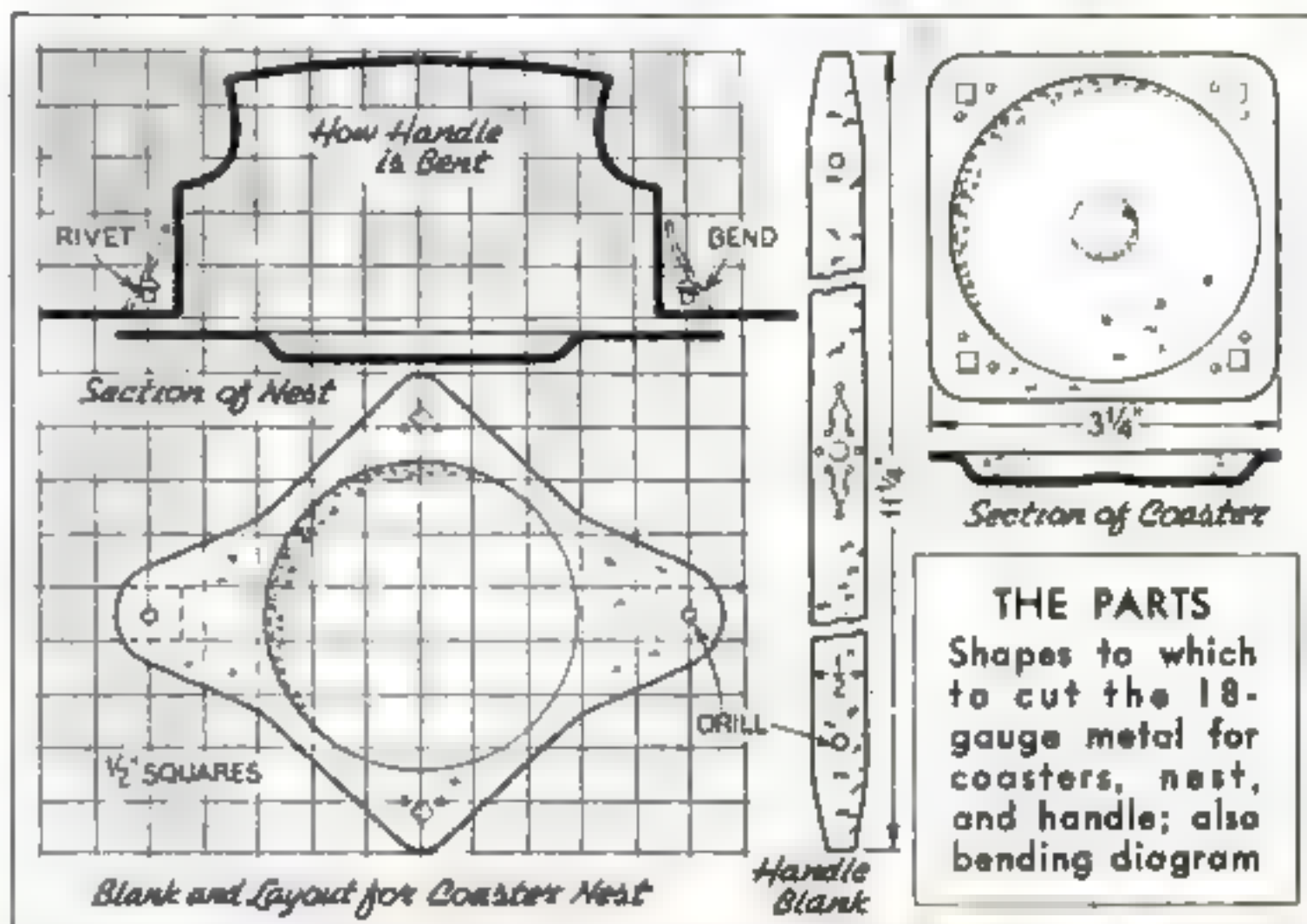
From a sheet of 18-gauge aluminum, lay out eight squares, each $3\frac{1}{4}$ by $3\frac{1}{4}$ in., cut with tin shears, and round the corners. Scribe a $2\frac{1}{2}$ -in. circle on each. By holding each slightly raised on an anvil, form a saucer inside the circle by driving down the metal with the ball end of a ball-peen hammer.

Set the piece flat on the anvil and smooth the bottom of the saucer evenly with a planishing hammer or the flat face of a machinist's hammer. A spot in the cen-

ter, however, should be raised as shown in the cross-section drawing. Next hold the piece against the sharp edge of the anvil and hammer the margin out flat. File the edges smooth and apply any desired design. In the example illustrated, the design was cut in with hollow punches.

The nest is cut as shown and after a circle $2\frac{1}{2}$ in. in diameter has been scribed, it is formed like one of the coasters. The handle is cut out, hammered on one side, bent, and riveted with aluminum rivets, after which the ends are bent up as indicated.

To produce a satin finish on the set, rub the pieces evenly with jeweler's fine emery paper.—D. H.



KALTENBORN EDITS THE NEWS

"HE GAMBLLED ON TIRES..AND LOST!"

Read H. V. KALTENBORN'S
Version of What Happened to a
Beechhurst, New York, Motorist

IT WAS nearing 2 P.M. The Whitestone Road was thick with a fast-moving stream of motorists. But Mr. Mitchell of Beechhurst, New York, scarcely saw them. All he had were visions of an hour in the dentist's chair. He could almost hear the bz-zz-zz of the drill when, suddenly, he heard something he was least expecting—BANG! A blow-out! The right front tire collapsed. Mitchell sat helpless at the wheel. With a lunge, he grabbed for the emer-

gency brake. But it was too late. A telegraph pole put a stop to the wild ride, leaving Mr. Mitchell with a crumpled car bumper—bruised knees—and plenty of regrets.

H. V. KALTENBORN

Motorists seldom realize that when the accelerator goes down, the heat *inside* the tire goes up. But Goodrich engineers knew that this internal heat was the great unseen cause of high-speed blow-outs. That's why they developed the Golden Ply, found only in Silvertowns.

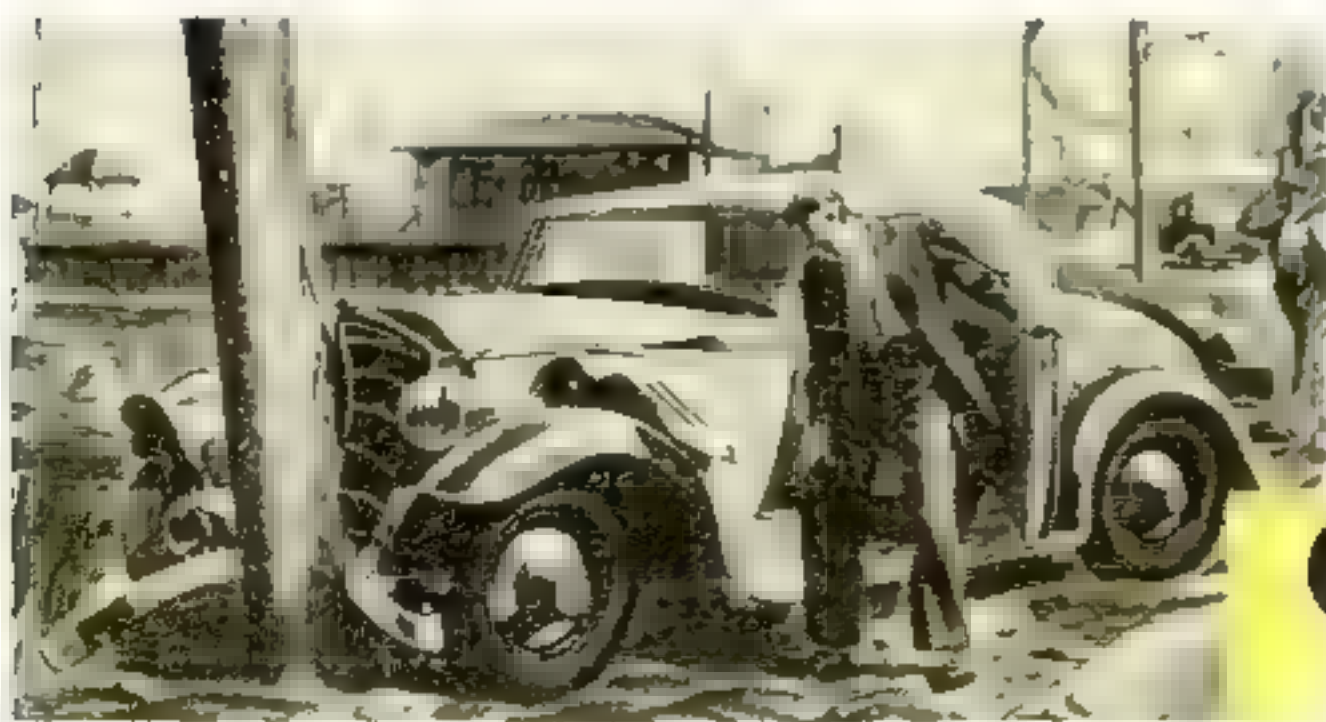
This Life-Saver Golden Ply is a layer of special rubber and full-floating cords, scientifically treated to resist the terrific *blowout-causing* heat generated *inside* all tires by today's high speeds. By resisting this *internal* tire heat the Golden Ply protects you against these dangerous high-speed blow-outs.

When you are urged to replace tread-worn tires with new safe tires stop at any Goodrich Silvertown Store or Goodrich dealer for a set of these life-saving Silvertowns. *It's better to be safe than sorry!*



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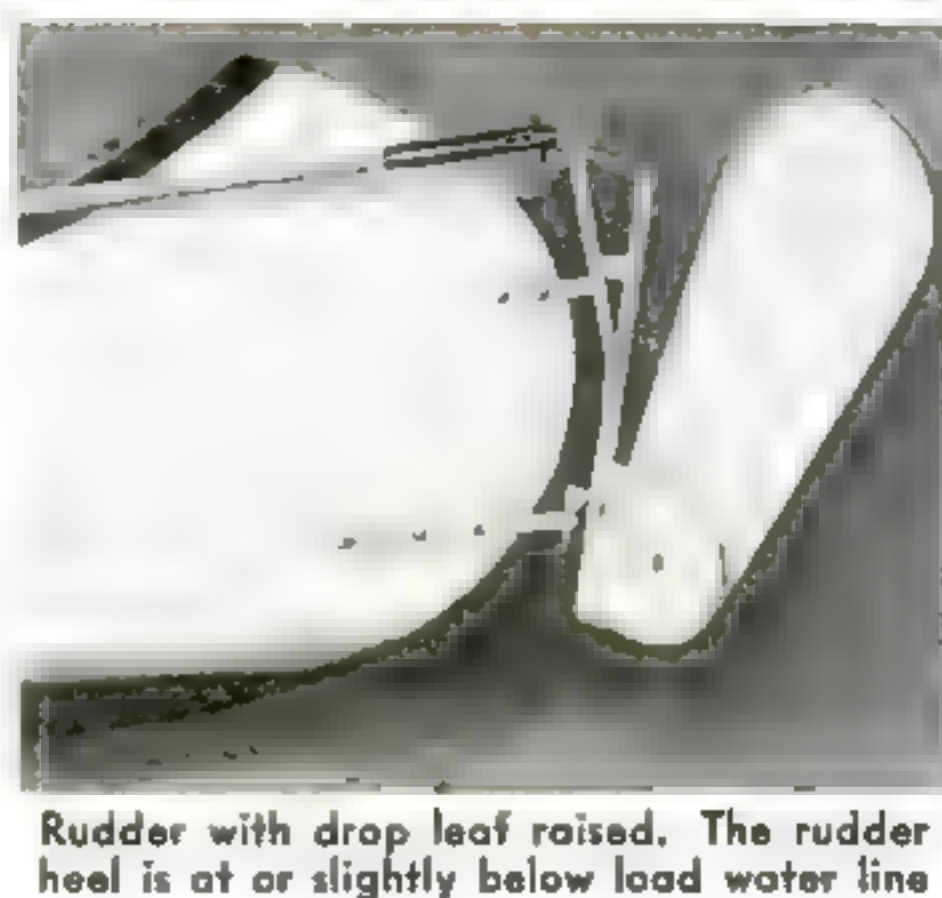
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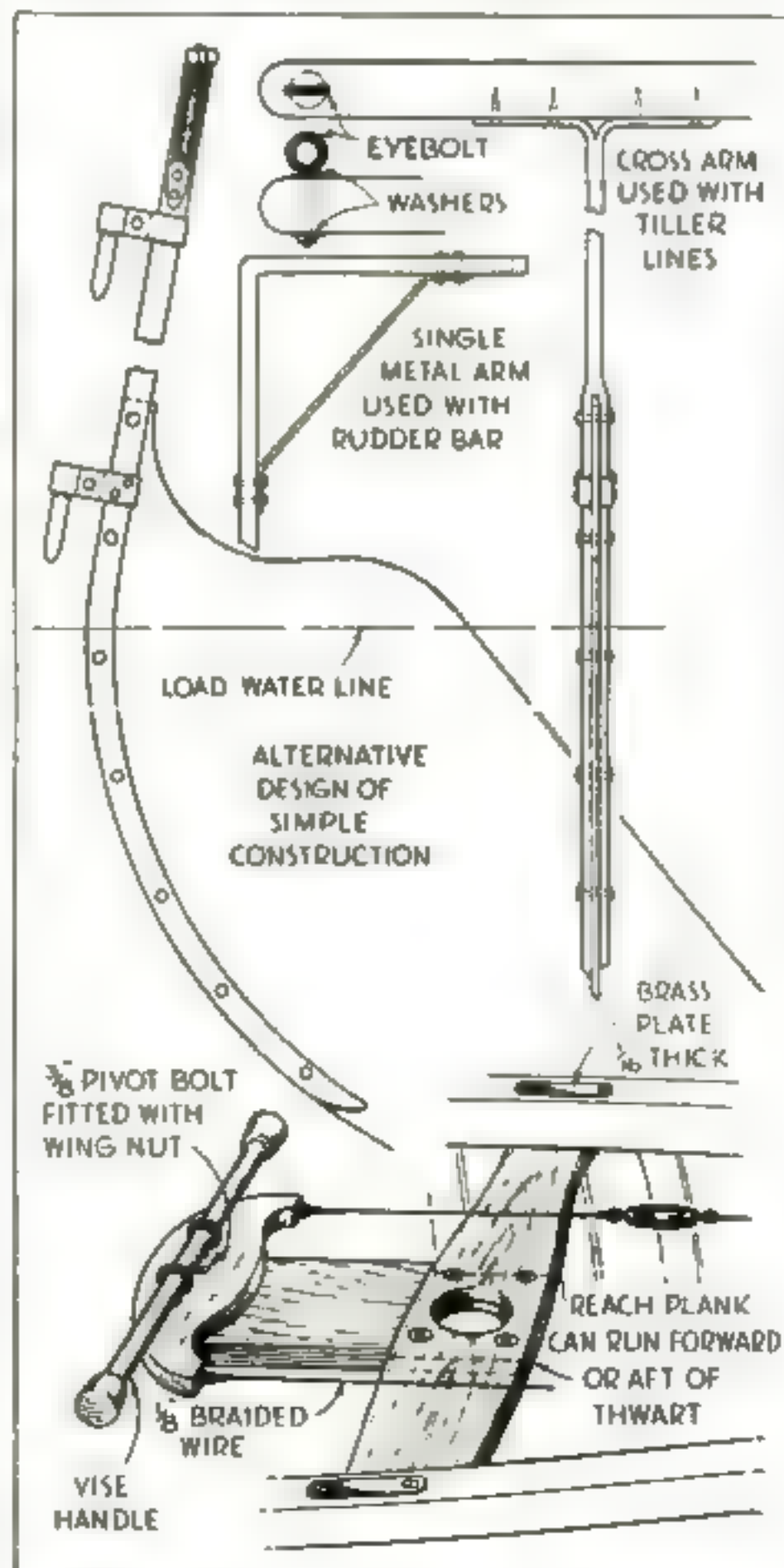
Rudder with drop leaf raised. The rudder heel is at or slightly below load water line

Good Steering Gear for Sailing Canoe

(Continued from page 87)

attachment of the steering gear may be simplified by sawing the head of the post and spreading it to take a yoke, from which tiller lines are led to a tiller head rigged as shown. Much metal work is dispensed with by this method, but I can vouch for the practicability because my own canoe was so rigged for a season or two.

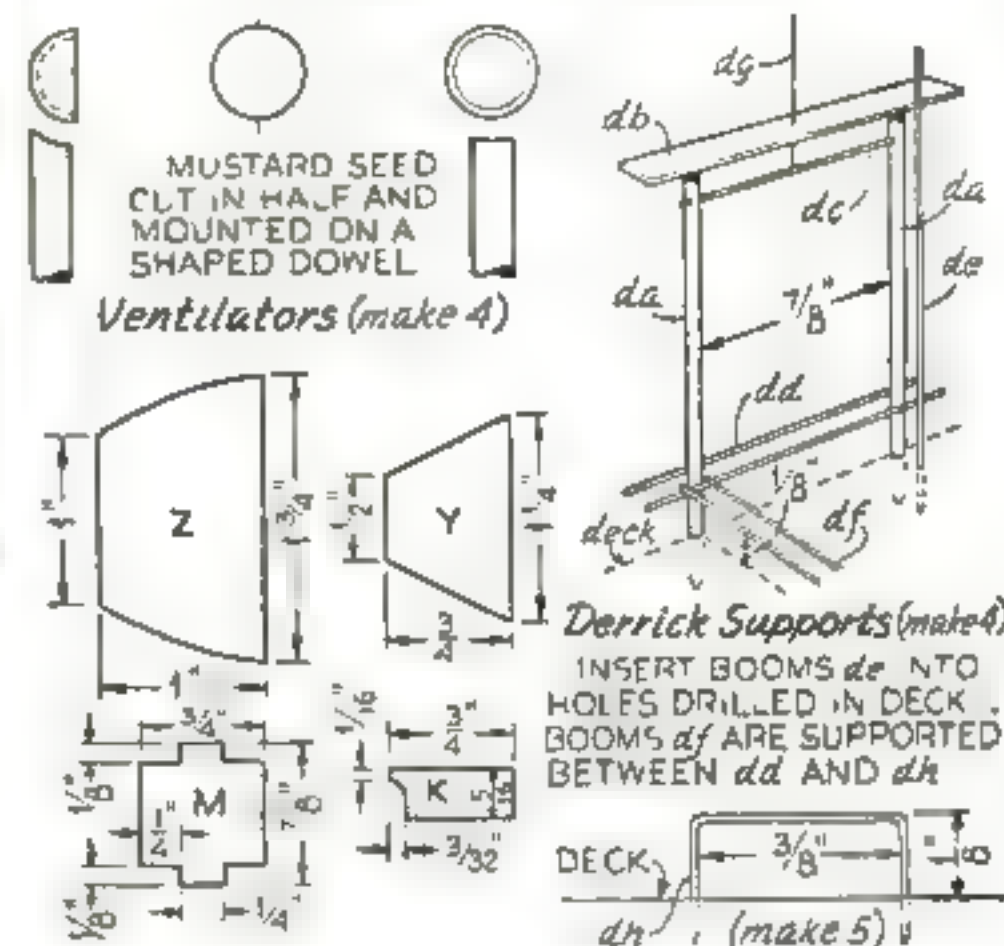
Rake, pickax, and hoe handles make satisfactory tillers and rudder bars, and a wood vise handle serves well as a tiller. Large screw eyes may be used as a tiller slide. Old real-estate signs are a good source of material for rudders. Discarded brass kick plates are often thick enough to make plates and tiller arms, and brass tubing from cast-off bedsteads is as good as anything for couplings, slides, ferrules, and the like.



A simple type of gear. It lacks the drop-leaf feature and has ordinary tiller lines

'President' Liner Model

(Continued from page 89)



low stripe along the side of the hull completes the model. Those not wishing to risk painting the stripe can obtain a similar effect by lightly gluing a tightly pulled yellow thread to the hull. The stripe goes where D joins B and C. A polished wood base about 4 by 18 in. forms a suitable mounting for the model.

List of Materials

WHITE PINE, BASSWOOD, OR BALSA

No.	T.	W.	L.	For
1	3/16	2	14 1/2	B
1	3/16	2	5 5/16	F
1	3/16	1 1/2	3 1/2	F*
1	3/16	3/4	3/4	M
1	3/16	9/16	1 1/4	P*
1	3/16	3/4	1 1/2	S*
1(a)	3/16	7/16	7/16	12 Lifeboats
1	3/16	2	14 1/2	Swimming-pool base*
1	3/16	2	14 1/2	A
1	3/16	2	14 1/2	C
1	3/16	3/4	3/4	D
1	3/16	3/4	3/4	E
2	3/16	3/4	13/16	N*
1	3/16	3/4	1 1/4	R*
1	3/16	3/4	2 1/4	T*
1	3/16	3/4	1 1/2	W*
1	3/16	3/4	1 1/2	Y*
1	1/16	1 1/2	4 1/2	G*
1	1/16	2	5 5/16	H*
1	1/16	1 1/2	1 1/2	J*
2	1/16	5/16	3/4	K
1	1/16	3/4	1 1/4	L*
2	1/16	3/4	3/4	O*
2	1/16	3/4	3/4	U*
1	1/16	1 1/16	2	V*
1	1/16	1 1/16	2	X*
1	1/16	1	1 1/4	Z
7	1/16	3/4	3/4	Large hatches*
2	1/16	3/4	3/4	Small hatches*
1	1/16	3/4	3/4	Swimming-pool top*
1(b)	5/16	3/4	1 1/16	Funnel*

NOTE: All dimensions are in inches. Items marked with an asterisk (*) require no further cutting or carving. The piece marked a may be made by gluing 1/16- and 1/4-in. pieces together, and b by gluing one piece of 1/16-in. stock and two of 1/4-in.

MISCELLANEOUS

Round wood, 1/16 in. diameter: 10 pc. 1 1/2 in. long for parts da; 4 pc. 1/2 in. long for ventilator bases.
Split bamboo, 1/64 by 1/64 in.: 20 pc. 1 1/4 in. long for parts df; 12 pc. 1 1/4 in. long for parts de; 8 pc. 1 1/4 in. long for parts dd.
4 pc. thin cardboard 1/16 by 1 in. for db.
1 pc. fiber 1/32 by 3/4 by 1 5/16 in. for Q.
4 pc. thin stiff wire 1 in. long for dc, 2 pc. for dg, and 5 pc. for dh.
32 pc. thin stiff wire 1/2 in. long for davits and deck stanchions.
1 pc. thin stiff wire 1 1/4 in. long for steam pipe.
6 small eyelets for windlass, hawse lips, etc.
2 pins 1/2 in. long for flagstaffs.
2 small squares of fiber for anchors.
1 in. of fine chain for anchor chains.
Small round mustard seeds for ventilators.
Black, white, red, buff, and gray paint. (White and black may be mixed for gray, and, if necessary, white with a little red and black to approximate buff.)
Glue or cement.

New Racing Sailboat

(Continued from page 99)

putty, and the seams calked and puttied with elastic seam composition.

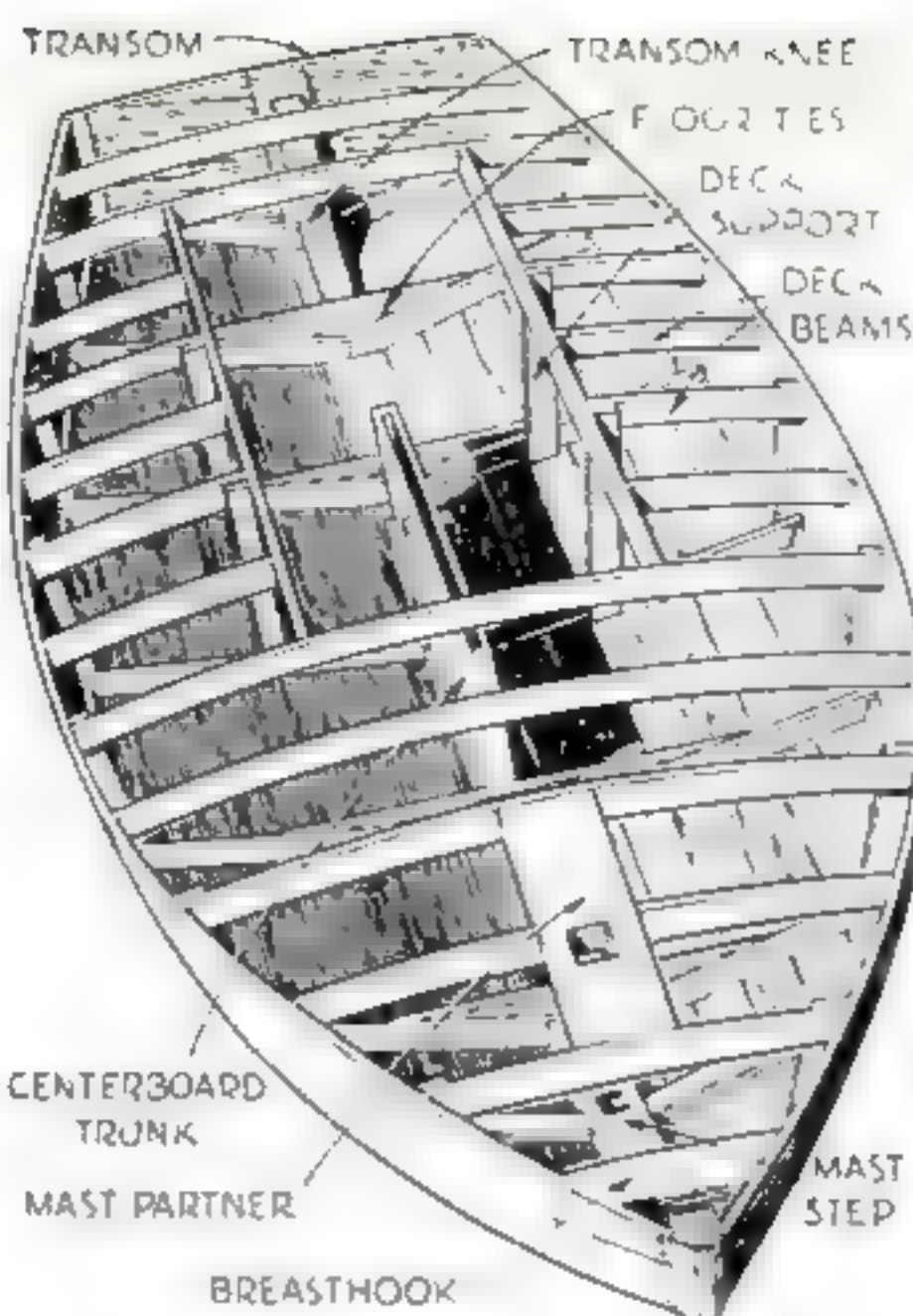
Use two or three strands of twisted cotton wicking for calking each seam. Do not drive it in; a calking wheel made with a large washer will do the quickest and best job.

The entire hull should have at least two and preferably more coats of paint or varnish. Marine enamel, or flat paint finished with a coat of varnish, can be used for the sides and bottom if the boat is to be sailed in fresh water. If the hull will be left in salt water, paint the bottom with antifouling copper paint. The deck, mast, and boom may be finished with several coats of spar varnish, but if the deck is canvas covered, the canvas should be filled with about three coats of flat paint.

The stem should be protected by a strip of half-oval galvanized iron or brass. Make the centerboard from 3/16-in. metal, following the dimensions given in the drawings that appeared in the previous issue, page 73.

Three stays should be used, each fastened to the mast with brass tangs as shown, and fastened to the sides and stem with chain plates, which are screwed to side frames No. 2 and to the stem with 2 1/2-in. No. 12's. The 5/8-in. sail track should be screwed to the mast and boom with 3/4-in. No. 6 round-head screws.

A traveler can be used for the sheet, or it can be rigged as shown in the photographs. Everything necessary for the rigging was given in the list of materials last month and can be bought



Assembly sketch, showing the frame parts through any marine hardware store. For best results the sail should be ordered from a regular sailmaker.

Sensitive Balance

(Continued from page 101)

beam. The stem of the wooden T slides up and down as illustrated through wire guides at the rear of the column. An adjusting screw is mounted above the arrester to limit its upward motion.

A rubber band at the bottom forces it up to the adjustment screw, which passes through a small nut soldered to the bracket. A lock nut is also desirable. The arrester is drawn down by a cord wound around a dowel shaft, which has a knob on the front end. Friction holds the arrester until the knob is turned in the opposite direction. Bearings are made from two pieces of wire wound around the dowel and driven into the base.

Varnishing. Two coats to wooden parts.

Assembly. Place central knife edge on its bearing and hang pan supports. Bring into equilibrium with the adjustment screw. Adjust arrester so that beam is supported, but not lifted clear.

On Bristol board, draw an indicator scale with twenty divisions, each 0.1 in., and glue near bottom of column.

The rider that slides along the right edge of the beam is a U-shaped piece of No. 40 enameled copper wire. Twist a small loop in the wire for moving it. It should be made larger than necessary, then reduced to such a weight that a 10-milligram weight on the left pan balances the rider on division 10.

For precise weighing, consult a text on qualitative chemical analysis. The rest point of the balance must be found in such work by averaging five consecutive turning points of the indicator. Three sets of readings are usually taken. The sensibility must also be determined—that is, the weight necessary to displace the rest point of the empty balance one scale division. Suppose the rest point is 10.3 with the rider on zero. Move the rider to division 3 (3 milligrams). Again determine the rest point. Let us say it is 8.8. The sensibility then is 0.003 divided by (10.3—8.8) = 0.002 grams or 2 milligrams.

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I HAVE ONE HARD AND FAST RULE, JIM. I GET MY LIFEBOUY BATH EVERY MORNING

BUT, JOHN, YOU DON'T MEAN I HAVE "B.O."? I TAKE A BATH EVERY DAY

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Approved by Good Housekeeping Bureau

Welding Equipment

(Continued from page 103)

Operating the Welder. In order to give a preliminary tryout, connect the reactance coil in series with the transformer to the supply line. Since the reactance coil limits the amount of current flowing through the transformer, it is advisable to have all of the reactance winding in the circuit until the user becomes familiar with the procedure. Later the leads may be connected to the reactance-coil terminal that will allow the proper amount of current for a given job to flow. For the sake of uniformity, the No. 1 terminal on the reactance coil should be left connected to the transformer, and the necessary variations made on the remaining terminals.

WEAR leather gauntlets as a protection against burns. Clamp the copper lug to a scrap piece of steel, place a pointed carbon rod in the holder, and practice striking an arc. If a regular carbon welding rod is not available, a "B" battery carbon will be a satisfactory substitute. It is easier to hold an arc with a carbon rod than it is when using a regular arc-welding metal rod, so the carbon is better to start with.

Welding rods are available in assorted types and sizes, each adapted for a particular kind of welding. It is advisable to have a supply of each on hand in sizes ranging from 1/16 to 3/16 in.

The transformer is so designed that it draws a negligible amount of current from the line when the arc is not being used. Each particular job will require a certain amount of current and a certain size rod to do the work satisfactorily. As the size of the job increases, that is, the depth and the width of the weld, more current will be drawn from the secondary, with a proportional increase in the current flowing through the primary. That fact should be kept in mind when connecting the welder to the supply line.

Where the supply line is No. 14, the current should be regulated by means of the reactance coil so that the transformer does not draw current in excess of which the line is fused. Where the supply line is No. 8 or larger, the transformer may be connected directly to the line for the larger jobs, without the use of the reactance coil. When an alternating current of 220 volts is available, the transformer will draw just half the current it would draw when connected to 110 volts, with the same output from the secondary. This permits a smaller size line to be used for supplying the current.

Carbon rods may be used for cutting and welding metals other than steel. Since carbon rods cause the steel to become rather brittle, it is advisable to use steel rods when welding steel.

The fourth and concluding article in this series will tell how to construct a spot welder.

Model Belaying Pins

WHERE economy rather than museum accuracy is important, ship model belaying pins may be made by cutting off the heads of 1/2-in. pins or small brass nails, depending upon the scale. Ordinary pins or dressmakers' steel pins will serve, if necessary, for stanchions, and the rail cord is merely looped around them and drawn tight.—J. B. N.

Write

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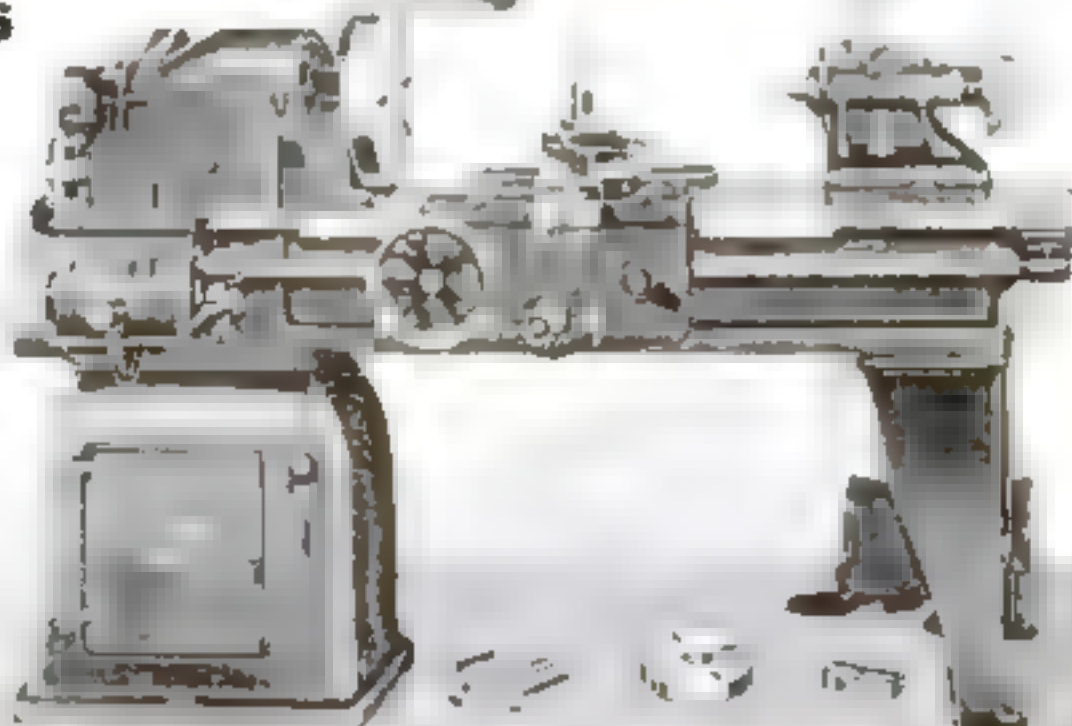
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KEENIZER PRODUCTS FOSTORIA, OHIO

Fire-Bug Hunters

(Continued from page 29)

enough money from your friends to pay me. Don't check it through your account, for that may call for explanation. Go to some city, as Chicago or New York, on a buying trip. We'll complete the job during your absence."

UNLESS the business man has had previous trouble, very likely he will beat the game and collect his insurance. One man, deciding he would burn his own establishment and collect some \$60,000 insurance, made detailed plans for the conflagration, rehearsing many times every step except the actual blaze. When everything was ready, he left town and crossed the continent from Los Angeles to New York to build up an alibi.

From the Pennsylvania Hotel in New York City, one night, he put in a telephone call for his fur store in a downtown Los Angeles building, checked off the seconds on his watch until he was sure the bell had rung fourteen times, replaced the receiver on the hook, and sat down to await results. Three hours later he was handed a telegram reading, "FIRE OF UNKNOWN ORIGIN COMPLETELY DESTROYED FUR STOCK THIS MORNING LOSS SIXTY THOUSAND HURRY HOME."

Little did he suspect, on reaching California, that firemen had found evidence which soon was to send him to prison. He was permitted to go ahead and file claim for insurance. Meanwhile, arson operatives moved speedily. They found he had come west a year earlier with a total capital of \$300. He had purchased \$5,000 worth of furs on credit and sold them at a profit. On the day of the fire, photomicrographs showed, there hung on his racks several score coats and wraps made of dyed rabbit fur and worth only a few dollars each—not the fox, mink, and Russian wolf which he had declared he owned.

But the trump card which was soon to start him toward prison had not yet been played.

One day, two police officers walked into his office.

"We have come to tell you about an interesting mechanical development," they told him. "It consists of a sliver of bamboo notched to fit over a telephone-bell clapper. At the other end of the sliver is a razor blade. When the telephone rings fourteen times, the blade severs a string leading to a spring which, when released, scratches a cluster of matches on the concrete floor and dumps them in a pile of papers. Do you follow us?"

"You've got me boys," he replied, his face blanching.

"WE PROBABLY never would have convicted this fellow," an operative explained to me the other day, "had the gadget worked properly. It started the fire, but for some reason a weight that he had hung twenty feet away, which he thought would jerk the bamboo off the phone and into the fire, failed to work."

Somewhere in the United States, every week, some master mind plans a fool-proof fire. Blazes recently were set in fifty hotels in and near Chicago. One name appeared on nearly half the registers at the time of the fires. When confronted with this simple fact, the man confessed, explaining that he had set the

fires because he enjoyed the excitement.

In Yonkers, N. Y., an arson "service" destroyed \$400,000 worth of homes, until operatives from the district attorney's office and the National Board of Fire Underwriters learned the identity of a member of the ring. Posing as home owners anxious to collect insurance, they made arrangements for a house, which they had leased, to be burned. Through a microphone hidden behind the ice box, conversations were recorded on thirty-eight phonograph records which sent three men to prison after they had accepted \$200 on account and agreed to call for \$900 more on completion of the job.

CIRCUMSTANTIAL evidence has convicted a higher percentage of arsonists than of any other type of criminal. This is necessarily true, for the crafty, cunning "torch" plans carefully. Yet the fire-setter—either amateur or professional—always leaves behind a trail of evidence which leads often to his apprehension and conviction.

In Los Angeles, for instance, the arson squad found in the trousers cuffs of several suspects over a period of years tiny bits of plaster. Microscopic examination revealed that the grains were bits of limestone, which look alike under a magnifying lens, no matter whether the stone was quarried in Maine or in South America. But also in those cuffs were detected almost infinitesimal quantities of sand. As the cases flowed through his office, Captain Wolfe studied sand and found that its grains differ with various localities.

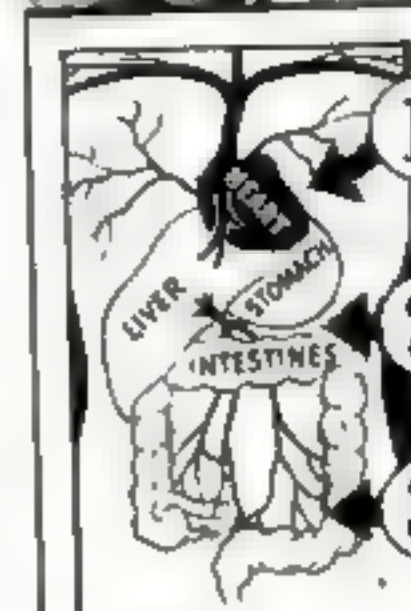
Not long ago, firemen battled a blaze in a downtown hotel, and in making a routine examination of the premises found fourteen "plants," consisting of paper and matches placed on shelves at points where the plaster had been chipped away, leaving the wood laths exposed. Strangely, only one had burned.

This called for expert inspection by the arson squad. From each "plant" investigators took a small quantity of plaster. In some of the exposed laths they found chisel-like marks. Sections of these were cut away for further study. In the manager's apartment they found, hidden behind a gas range, a long knife, broken and sharpened, which fitted the lath marks. From the trouser cuffs of the manager and the apron pockets of his wife, and from under their finger nails, they took bits of plaster-like material.

BACK at headquarters, they examined the sand in material taken from the fourteen incendiary locations and from the couple, and found each lot of fifty grains averaged about eighteen black, six white, thirteen amber, and thirteen red. Confronted with this positive evidence connecting them with the "plants," the couple confessed to setting the fire for insurance.

Arson sleuths from coast to coast have good reason to wage unrelenting war on the clever criminals who burn buildings and goods, for Uncle Sam's fire bill surpasses that of any other nation. Slowly the fire-bug hunters are winning. In one city, fire-insurance premiums have dropped from \$18,000,000 to \$9,000,000 in two years—partly because of the successful war on arson.

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**Why it builds up
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Doctors now know that the real reason why many do not gain weight is that they don't get enough Vitamin B and iron in their daily food. Without these you may lack appetite and not get the most body-building good out of what you eat.

Now scientists have discovered that one of the richest sources of health-building Vitamin B is English ale yeast. By a new process the finest imported English ale yeast is now concentrated 7 times, making it 7 times more powerful. Then it is combined with 8 kinds of iron, pasteurized whole yeast and other valuable ingredients in pleasant little tablets called Ironized Yeast tablets.

If you, too, are one of the many "skinny" wornout persons who need these vital elements to aid in building you up, get these new Ironized Yeast tablets from your druggist at once. Day after day watch flat chest develop and skinny limbs round out to normal attractiveness. Indigestion and constipation from the same source quickly vanish, skin clears to normal beauty. Soon you feel like an entirely different person, with new charm, new personality.

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No matter how skinny and rundown you may be from lack of sufficient Vitamin B and iron, try these new "3-way" Ironized Yeast tablets just a few weeks and watch the marvelous change. See if they don't aid in building you up, as they have helped thousands. If not delighted with the results of the very first package, your money instantly refunded.

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Sports Photography

(Continued from page 106)

type of action must be determined by experiment.

When the action is moving in a variety of directions, as in a soccer game, you must either use a faster shutter speed or move farther away from the action in order to avoid blurred pictures. Sixty to one hundred feet is about right for a 1/30-second shutter. At this distance your pictures will be very small, but the action will be clearly defined.

There is still a third method that often can be used when other means fail or are inconvenient. This is the trick of swinging the camera. The way to do this is to follow the action in your finder and when everything seems right, snap the picture. The background will probably be blurred, but the action should be clear. This is another trick that takes a little doing before it produces results, but the results can be very gratifying.

A few words of advice may be added, and the first is that you must not be too impatient to take pictures. Decide what pictures you want, look the situation over, and plan the best way to get them. Then, and only then, take them!

Sometimes an otherwise mediocre sports picture can be vastly improved by tilting it. Either tilt the camera while making the shot, or arrange the borders on the print so that you get the same effect. The result in either case is to lend the illusion of motion.

Another important thing to remember is to get the face of the athlete in the picture whenever possible. It is the face with its expression of agony or intense effort that helps to dramatize a picture and makes it something you will be proud to enlarge and exhibit.

How to Improve Ground Glass for Focusing in Dim Light

Users of cameras with ground-glass focusing screens find it very difficult to focus in dimly illuminated places. Many remedies have been suggested, among them being the use of oil, such as petrolatum, which is rubbed over the ground-glass surface. This will help, but it is at best a makeshift since dust and finger prints cause much difficulty.

A permanent and efficient device for focusing in dimly lit places can be made, however, by cementing a microscopic cover glass in the center of the ground glass on the ground side with transparent cellulose cement or similar cement. Clean the surface with alcohol and put a globule of the cement in the center. Place the clean cover glass on top and press firmly to expell the surplus air and cement. Dry under extreme pressure so that no air enters.

It will be found in dim light that the image under the cover glass is far brighter.—NATHAN SPERBER.

Utilizing Drawers Taken from Old Sewing Machines

Tiers of drawers from old, discarded sewing machines may be removed and fastened under a workbench to provide a safe and comparatively dustproof place for keeping micrometers, levels, and other small tools. If you can obtain four or more tiers of the drawers, they may be made into a separate cabinet by screwing them together on a plywood backboard.—N. F. DEGAGNER.

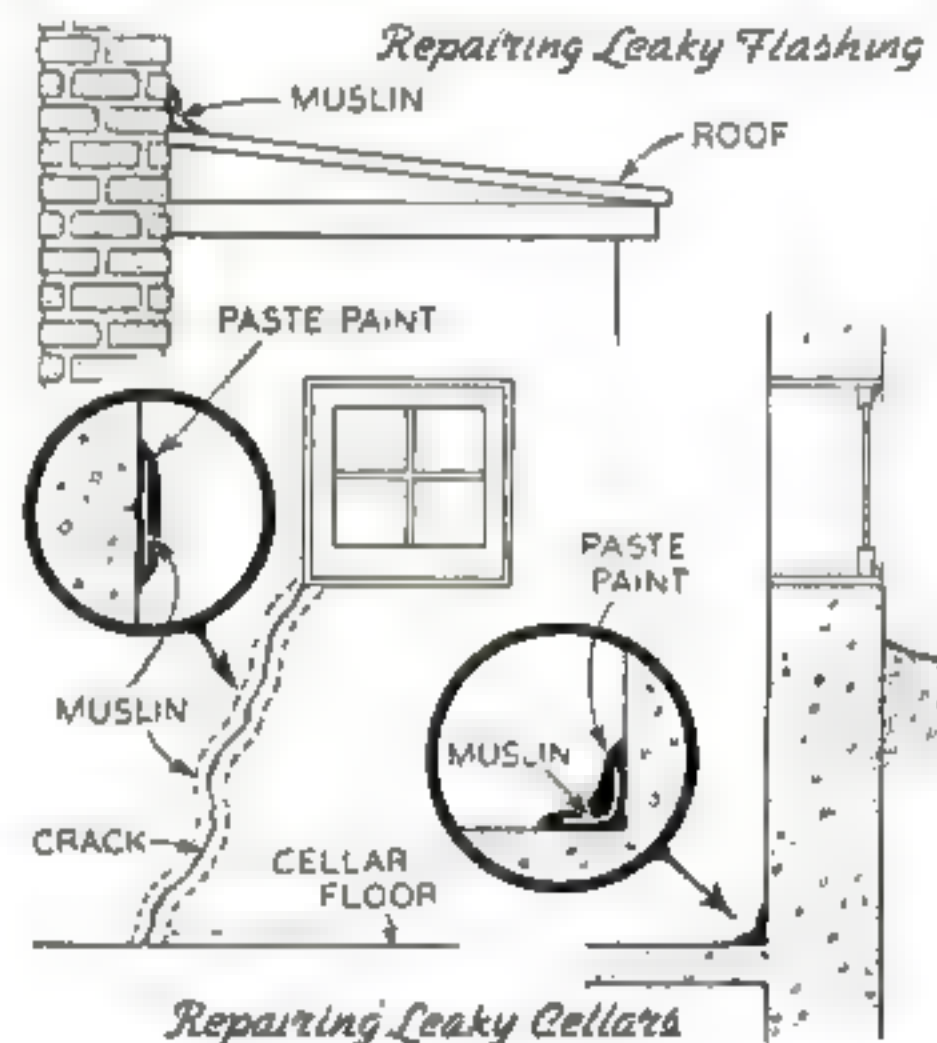
AUGUST REPAIRS

SUMMER, with its long hours of light, affords a fine opportunity for making repairs around the home and garden. Following are some suggestions for August:

- Repair and repaint garden furniture.
- Replace worn-out plumbing.
- Partition off workshop in cellar.
- Install shower inclosure in bathroom.
- Build extra kitchen cabinets and shelves.
- Change door to arched opening in living room.
- Provide extra towel racks.
- Reconstruct dry wells; carry drainage from leaders farther from foundation.
- Improve appearance of cellar with a ceiling.
- Construct concrete, stone, or brick walks, terrace, or steps.

Paint in Paste Form Used for Checking Leaks

I HAVE successfully stopped leaks through a cracked concrete cellar wall and in the metal flashing of roof joints by the use of very thick paint and muslin. The paint should be of the paste type, and drier must be added if there is none in the paint. It is applied as heavily as possible for a width of about 1½ in. on both sides of the crack and also along the joint between the cellar floor and the wall, if necessary. A mus-



Typical repairs, exaggerated for clearness

lin strip 1½ or 2 in. wide is then moistened with mineral spirits or turpentine and laid over the crack or joint on top of the paint. Another coat of the paste paint is applied over the muslin. When this dries, a very hard and tough film is obtained through which no water can seep.

In repairing a leaky flashing or roof joint, the same method is used except that a roof paint or an asphaltum roof paint is used.—R. L. E.

Waxed Paper under Casters Helps in Moving Heavy Furniture

DIVANS and other large, heavy pieces of furniture may be moved easily without scratching the floor if a folded sheet of household wax paper is placed under each caster.—GEORGE H. BRINDLEY.

Musical Magician

(Continued from page 47)

trumpets of differing length and diameter.

Two other wind instruments in Weideman's collection deserve special mention. One is a set of pipes which he made by slicing off the ends of turkey bones, sealing them with several coats of varnish, and mounting them in a row in a wooden frame like the primitive Pan-pipe. Blowing into the bones as the instrument is moved back and forth in front of the lips produces strange musical tones.

THE principle of the trombone is applied in a device that consists merely of a vial of mercury and two hollow glass rods of different diameter. The mercury is poured into the larger tube, and the smaller inserted in it so that its lower end is immersed in the mercury. As Weideman blows into the upper end of the smaller rod, he slides the larger one up and down, thus causing the mercury to change the effective length and therefore the pitch of the inner rod.

Most spectacular of all the instruments that Weideman has made are those which he has adapted from the conventional xylophone. One of these, a giant xylophone with cardboard mailing tubes for resonators, is believed to be the largest instrument of its kind ever constructed. Five persons can play on it at the same time, and several of its resonating pipes are so long that they had to be bent at right angles like stovepipes in order to make them fit into the frame.

His latest achievement, however, is the "celestaphone," a kind of xylophone that has tuned strips of plate glass in place of the usual wood vibrating bars. Seventy-two of these glass strips are ranged along resilient rails in the twelve-foot instrument, which has a tonal volume as great as that of a pipe organ. The only one of its kind in the world, the "celestaphone" can produce notes an octave higher and an octave lower than any xylophone yet manufactured.

By the time this is read, however, the "celestaphone" may be gathering dust in a corner, temporarily abandoned by its owner while he tests the musical qualities of a load of bricks or a carton of safety pins. If that sounds too fantastic, consider the fact that Professor Weideman has one instrument in his collection that is made from the fossilized bones of a rhinoceros that roamed the earth more than 75,000,000 years ago!

National Bird Census

A NATION-WIDE census of nesting birds, to be conducted by cooperating bird students, was recently announced. Each voluntary census taker selects a definite area of from fifteen to 150 acres, and makes a rough sketch map showing its topography and vegetation. The census-taking involves that each bird's nest in this area be found and marked, but where nests are too well hidden to be actually seen, certain evidences of their existence are to be accepted. At five-day intervals during the breeding season, the territory has to be gone over carefully, and every change in the nesting arrangements and mating of pairs is to be noted. All records will be collected centrally, and recorded in microfilm form. The census, if successful in its objects, is to be repeated annually.

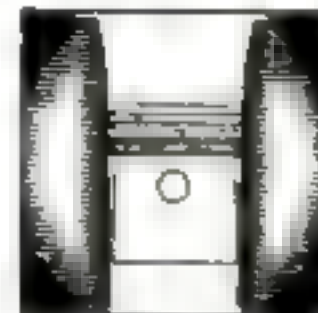
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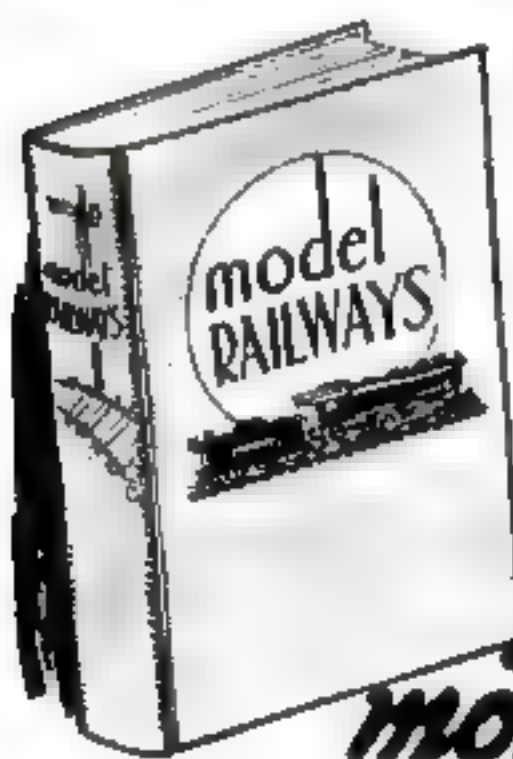
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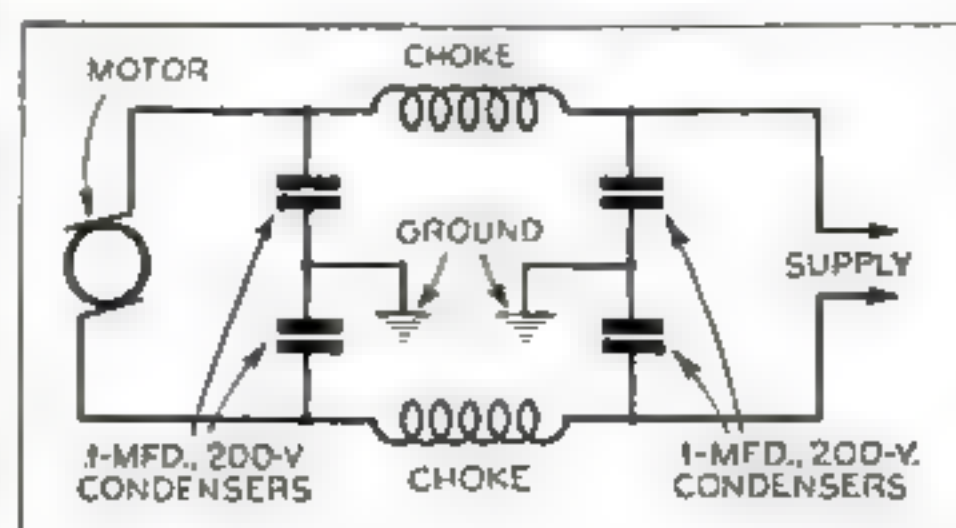
When Your Radio Goes to Sea

(Continued from page 75)

One of the best ways of eliminating this trouble is to connect into each motor lead a filter consisting of a radio-frequency choke and grounded condensers, as indicated in the diagram. A suitable radio-frequency choke can be made simply by winding about twenty turns of insulated wire (generally No. 14, or whatever size is necessary to carry the motor current) around a broom handle, and then removing the coil from the handle. Usually the choke will retain its shape without further treatment, but it can be taped or coated with varnish or wax. Between each end of this choke and the ground, connect a 0.1-mfd., 200-volt paper condenser. Thus a typical two-wire motor will require two chokes and four condensers. Often larger condensers, up to 0.25 mfd., will prove more efficient. A little experimenting will soon reveal the best hook-up.

A COMMERCIAL type of radio receiver that is fast gaining in popularity for general boat use is the standard six-volt automobile set. When suitable current supplies are available, small table-model receivers can be employed. More satisfactory, of course, is the special custom-built marine receiver that operates on a battery when the craft is at sea, and on a regular 110-volt lighting circuit when in port. Such receivers generally are made to cover the short-wave as well as the broadcast band, and may operate two or more auxiliary speakers in various parts of the boat. When standard automobile sets are used, those having motor-generator units rather than vibrators for obtaining the high-voltage plate current are more satisfactory.

For boats operating on fresh water, the problems are less difficult, but it will pay to take reasonable precautions against damage by moisture, heat, and similar agents.



How filters are connected to leads of small electric motors to eliminate bad interference

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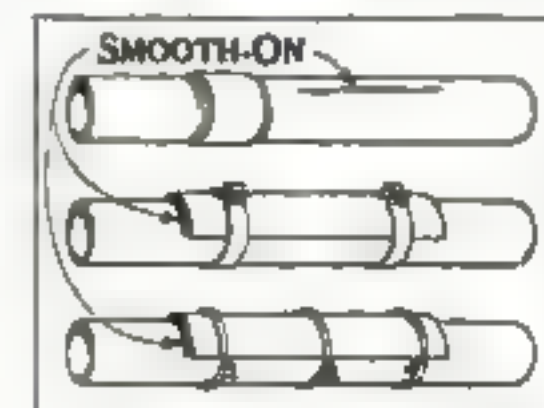
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Loose handles

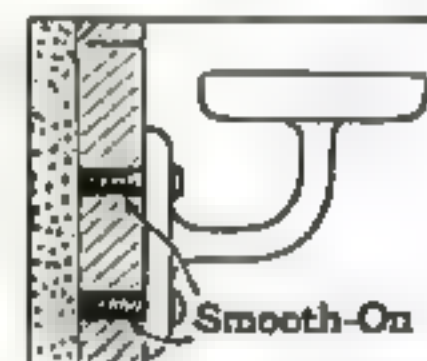
EVERY household-er has his unlucky days, when something suddenly leaks, breaks or comes apart, but—you can laugh at many such emergencies and save much money if you keep a can of Smooth-On No. 1 handy and do your own repair work!



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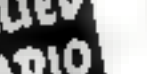
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(Continued from page 63)

Ants in your artificial nest should be fed dead beetles, earthworms, flies, and scraps of meat. A few like cereal grains. They are mad for sweets, and take to them like drink; doubtless the sugar does give them an alcoholic reaction. But they must not have too much, or they will neglect more wholesome food. Ants need not be deluged with water. They get enough if the soil is gently moist throughout. A tuft of sponge, with the water on it renewed often, suffices.

When you dig up your nest, you may find that you have brought along queer little blind beetles and tiny caterpillars. There may even be minute ants of quite another kind. Don't try to exterminate these. They are all ant "guests" who raid their hosts' larders, snatch their offspring, or rush in between one ant feeding another and steal the morsel. True, they are moochers, gold-diggers, snatch-racketeers, but they add to the excitement of the ant city.

Ants work like Trojans, but you'll find many resting. The halt and the lame, the diseased (they get fungous troubles as we do bacterial diseases), and the dead are unceremoniously dumped out on the hill above ground. However, the wounded for whom there still is hope are fed, licked, and stroked by their friends.

Observe the sanitary measures. Waste products are cleaned out of the streets—and especially out of the nurseries—and packed down in the dirt and covered with clean sand.

TRY some experiments on "the mankind of insects." Put your ant palace again on a table with the legs in saucers of water. Connect two or more tables by paper bridges. On one of the tables place a bit of honey—or, better, several pupae ("eggs"). Take the first ant that comes out, and put her at the prize. While she examines the find, daub her back with a tiny speck of fresh white paint, so that you can recognize her. Presently, she will go home and lead out some friends. Probably she will make straight for the prize, remembering the way. But, in the meantime, you will have exchanged the bridge that led to the treasure island for some other bridge.

Now, if she has been able to give her friends a precise idea of what they are to look for and where it is, they should go straight after her and find it. In my experience, they don't do this. They wander languidly all over, and no more of them find the prize than might do so by sheerest chance. If anything, they are more inclined to go over the bridge

SIGHT must be a far different affair among ants from what it is among humans. But, whatever it is they see through their queer, compound eyes, they are more sensitive to color than we. Try admitting light into the nurseries and royal apartments through glasses of different colors. If you let blue or violet rays into the nurseries, the nurses usually rush their charges away as if there were a fire in the orphanage. If you lay pieces of colored glasses all over the nest, letting in light everywhere, your ants, if they behave like mine, will shift to parts representing the low-vibration end of the spectrum, the dark reds. Experiments show that they seem to be agonized by ultra-violet rays, and appear most happy under infra-red.

To test the theory that ants tell direction by the sun, I captured an ant out of the nest in the morning, shut it in a box till afternoon, and let it out. The sun's shift had indeed deceived the poor creature. I also captured an ant on its way home, put it in a dark box, and carried it over its own nest and beyond. Released, it kept right on going in the same direction as it had started. I didn't wait to see if it got home by way of China.

We assume that ants help each other. My magnifying glass seems to throw doubt on the idea. Fully half the time, two ants will tug opposite ways on the same prize. Everybody asks if ants are intelligent. If you mean by intelligence the ability to learn from experience and adapt behavior for betterment, then ants are only slightly, or by exception, intelligent. Instinct takes care of them, instead. Instinct is the ability to do a necessary act without previous experience. Ants, as well as men, are born with their instincts; they can't acquire them by any amount of experience.

Besides instinct, ants obey, as we do, what are known as reflexes, of which sneezing is a human example. They are subject to tropisms, or tendencies to react to certain stimuli in definite ways; moths going to light, roots seeking water, are following tropisms. Ants seem like automatons, and yet anybody who watches them patiently enough will probably conclude that they are a little more than that. They have, it must be admitted, the rudiments of individuality and intelligence.


THE more you watch, the less you may come to think of our vaunted human intelligence, our cocksure civilization. Among the ants everybody works—except the drones, and even they have their appointed task. Everybody shares, though by no means alike; women (the queen) and children come first. There are almost never any revolts or sit-down strikes; gangsters, parasites, profiteers, and hijackers are not known among them. They leave these vices to their curious little “guests”—and to the strange, two-legged giants who peer down at them with such confidence of superiority.

(Continued from page 76)

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A BYSTANDER's estimate of the speed of a passing automobile is likely to be far from correct, recent tests by the Royal Automobile Club of Sweden show. More than 20,000 separate observations, in which would-be judges were allowed to see a passing automobile and write down their estimates of its speed showed that more than half of the people tested were wrong by twenty percent or more. Not even a fifth of the persons tested could estimate speeds within five percent of the true figure. Tests were made under many conditions of light and darkness, on roads of different pavements and grades, and with the cars driven in different gears. The experiments indicate that professional test drivers, mechanics, and others who might be expected to be the best judges of speed, are no better than ordinary people. Even under the most favorable conditions, the investigators conclude, human judgment of a car's speed is unreliable. It is still worse if traffic or unfamiliar conditions confuse the observer.

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Microscope Crime Detection

(Continued from page 67)

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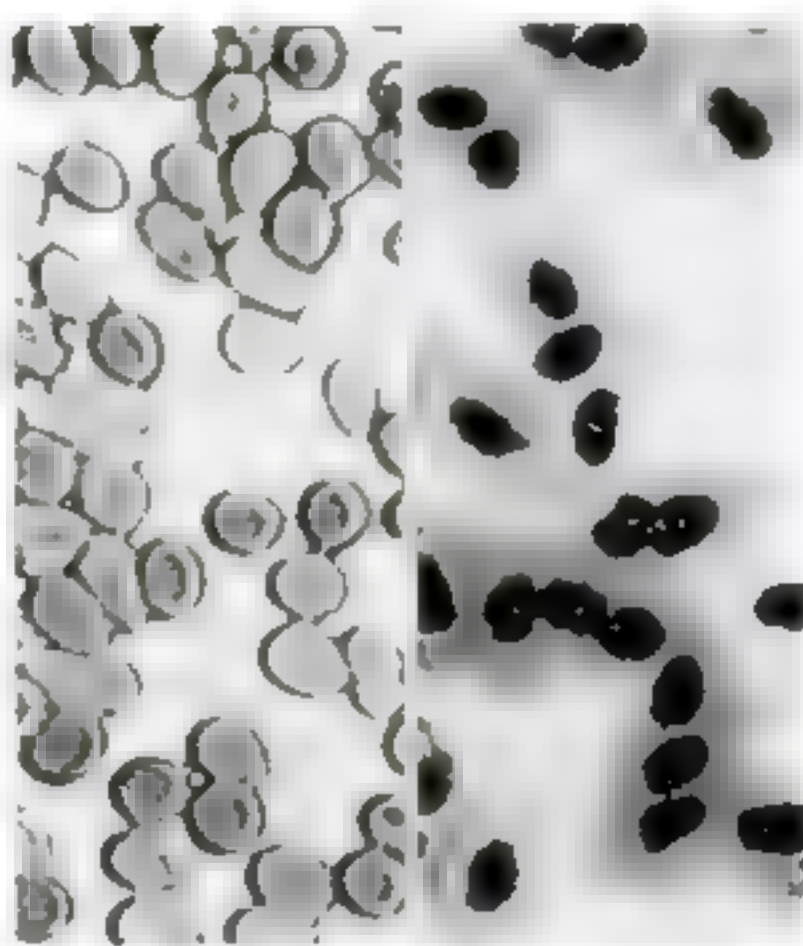
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steel found in his clothing with the steel in the death instrument. When you grind steel on an abrasive wheel, two kinds of particles are formed. In addition to numerous ragged, irregular chips torn out of the metal by the sharp abrasive grains, there are tiny globules formed when the sparks produced by grinding cool. These globules, for a given steel, assume characteristic shapes and appearances, which the microscope reveals clearly.

By studying known specimens until he has become so thoroughly familiar with their appearance that he will recognize them the next time he sees them, the



Human blood corpuscles (left) compared with those of a cobra. The absence of nuclei in the corpuscles identifies the blood of a mammal.

microscopist can learn to identify various other kinds of dusts. Or, he keeps a collection of specimens on hand, which can be used for comparison purposes. This, incidentally, is the secret of most criminal-investigation work carried on with the aid of the microscope, and accounts for the fact that the Bureau of Investigation of the U. S. Department of Justice, maintains extensive collections of textile fibers, hairs, bullets, cartridges, typewritten characters, and the like.

IT IS relatively easy for the microscopist to distinguish a human hair from animal hairs. Examine the hairs of mice, cats, dogs, and sheep. You will soon learn to identify the characteristic differences. You will see, for instance, that sheep wool has coarse surface markings, like a file. Hog bristles taken from a shaving brush, on the other hand, reveal no outer separate bark like that found in human hair.

There are an amazing number of things that the experienced eye can find in a hair by examining it through the microscope. It can classify that hair according to its color, surface markings, the race of the person from which it came, scales adhering to it, the way in which it was removed from the body, and the part of body from which it came.

When a microscope shows that a hair found under a murder victim's finger nails looks exactly like one from a suspect's head, there is almost no chance that the instrument is wrong.

Your examination of vegetable tissues and fibers—looking at the coil-spring walls of ducts and tubes in leaves and

stems, examining the silica skeletons of plant parts, and observing the cellular arrangement of leaves—is a type of microscope work highly useful in criminal investigation. For example, it may be important to establish what a murder victim ate during the meal preceding his death. By analyzing the contents of the stomach and intestines, a skilled microscopist can tell with amazing exactness just what was in that last meal. He does this by studying the microscopic structure of particles of food—either undigested, digested, or at some stage between—found in the body.

YOU will find it interesting to examine, with a microscope, some of the bits of solid material from vegetable soup or some other food preparation. Among the vegetables you can identify many familiar features such as the structure of cell walls. Beef and other meats show characteristic muscle fibers. To examine, say, a fragment of cooked cabbage leaf, tease it apart in a drop of water on a slide, and then add a cover glass. Examination of many kinds of leaves—celery, lettuce, spinach and so on—will demonstrate the ways in which they differ in appearance under the microscope.

Blood plays an important part in many crimes and mysteries. The microscopist can, by the simplest examinations, readily distinguish between blood and such materials as red paint, which might look like blood. The blood contains characteristic corpuscles, or cells.

To determine whether the blood is human or from some animal such as a horse, the microscopist examines the corpuscles more closely. The red corpuscles of mammals are in the form of circular disks, without nuclei. Red corpuscles from non-mammalian forms of animals, such as chickens, are oval in shape and contain prominent nuclei. Human blood can be distinguished from other mammal forms by measuring the diameters of the red cells with a micrometer attachment. Human corpuscles (red) range in diameter from about 1/3,100 to 1/3,500 of an inch, while those of other mammal blood likely to be confused with human blood in criminal work are generally smaller.

BUT blood corpuscles cannot always be depended upon to furnish identifying details. Sometimes they have been destroyed by various agencies, so that they cannot be examined with a microscope. Then the little trick of preparing hæmoglobin and hæmin crystals becomes valuable. There are pronounced differences between the crystals prepared from human blood and those derived from the blood of other animals, so by making slides of the specimen being tested as well as of blood that is known to be human, it is easy to tell whether or not they are the same. The crystals can also be used to distinguish blood from other stains, such as ink.

You can make hæmin crystals without much difficulty. Place a little of the blood or fluid supposed to contain blood on a slide, add a small amount of common salt and a drop of glacial acetic acid, and heat to boiling over a flame. When the slide is cool and dry, add balsam and a cover glass in the usual manner.

(Continued on page 123)

This One

This One



AJNA-B35-1T6F

Microscope Crime Detection

(Continued from page 122)

A still more positive blood test is a chemical procedure that narrows human blood down to one of four type groups, making it possible to establish true parentage and solve other questions. This test is hardly within the scope of the amateur microscopist.

The identification of textile tissues is another important job for the criminologist's microscope. It is a relatively easy matter to make such identifications quickly and positively, once you have become familiar with the various fibers such as different kinds of wool, cotton, linen, silk, and hemp. Examination of the surface of a fiber is not always sufficient, and cross sections may have to be made.

IF YOU examine the fibrous structure of several different pieces of writing paper which may look alike to the naked eye, you will discover that they differ considerably. By soaking pieces of paper in water, perhaps treating them in a solution of potassium or sodium hydroxide (lye), you can secure individual fibers for examination. The identification of paper may be an important item in a criminal case involving forgery. The comparison microscope is used frequently for matching paper samples.

The microscopist who possesses a camera attachment for his instrument can make comparison studies of almost anything—typewritten characters, handwriting, bullet markings, cartridge markings, paper samples, steel particles, and so on—simply by making two photomicrographs, one of the known speci-

men and one of the unknown, and comparing prints or negatives by placing them side by side or one over the other. Of course, the magnification must be exactly the same in both pictures. This method is slower and more expensive than the procedure when a comparison microscope is available, but it is positive, and has the advantage that the results can be preserved indefinitely.

A FORTUNATE angle to much crime-detection work with the microscope is that it is done at low or medium magnifications. Examination of fingerprints, forged signatures, and the like can be done with a hand lens magnifying seven and a half diameters or thereabouts. The lowest powers of your microscope will suffice for much of the examination of vegetable tissues, metal fragments, and so forth. Higher powers are useful for studying starch grains, blood cells, crystals, and various hairs and fibers.

You can have a lot of fun by joining other microscopists in tracing down "clews" of various kinds with your instruments. You can stage a "crime," sprinkle some dust such as cornstarch around, and let your friends identify the dust. Or make as perfect a copy as you can of a signature, and then let someone determine which is the original writing and which the forgery. (The forged signature will show wavy lines, retracings, and other flaws when magnified a few diameters.) By such stunts, you can have a lot of fun, learn a lot about microscope technique, and get a taste of modern criminal investigation.

Champions in Harness-Horse Racing

(Continued from page 40)

breakfast consisting of four quarts of oats and a ration of hay. At noon, it gets four quarts more of oats, and at supper-time another four quarts with a little mash added. This is fully twice as much as a work horse is fed, for the training routine consumes great amounts of energy. The oats used are of special quality, largely imported from South America. Yeast, mineral oil, and salt are occasionally added to the mash. Carrots and apples also are sometimes included in the diet, and many horses relish a nibble of sugar or tobacco.

TWO days a week are devoted to intensive speed training; the other days to three or four-mile jogs to develop stamina. On the two "hard" days, usually Monday and Wednesday, work begins with a 2½-mile jog, followed by a mile run in about 2:45. Then the horse returns to the stable for a rub-down, a few mouthfuls of water, a twenty-minute rest, and a new harness. Back on the track it practices "scoring down" or making flying starts past the judge's stand. Instead of lining up behind a barrier, harness horses are started a hundred yards or so back from the judge's stand. They maneuver into the positions they have drawn and thunder past the starting line at full speed. Unless the entries are in their proper positions, the judges sound a gong and bring them back for another try. These attempts to get away for an even start are called scoring. Sometimes, more than a

dozen attempts are made before the starter gives the word go.

Great drivers, like "Pop" Geers, Tommy Murphy, Sep Palin, and Ben White, always helped their horses by headwork at the start of a race. They intuitively seemed to know when the judges would call them back for another try, and stopped their horses at once to conserve energy. During the \$10,000 Governor's Stakes, run at Syracuse, N.Y., last year, it was estimated that the sixty-year-old veteran, Ben White, saved the winner, Rosalind, fully a hundred yards of fast trotting on every score. She won the event in straight heats. Ben White's uncanny judgment gave her all the breaks, and she probably trotted a mile less than some of the other horses in the race.

IN TRAINING, after the practice in scoring down is ended, the horse is put through another mile, this time at about 2:30. Then it goes back to the stable for another rest, rub-down, and change of harness. On its third trip to the track, it scores down three or four times and runs a mile at a fast gait, the time depending upon the stage of the training. As the season progresses, seconds are clipped from the time on this fast circuit of the track.

The drivers carry stop watches, even during races, to keep track of the time for the different quarters. Only one trainer on record never used a stop watch. He (Continued on page 124)

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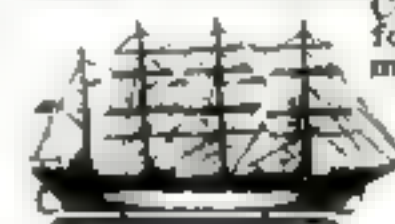
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Champions in Harness-Horse Racing

(Continued from page 123)

was a Negro with an amazing judgment of pace. It is said that he could take a horse around a mile track in within half a second of the time set before the start.

Some horses train better than they race; others race better than they train. It is a matter of temperament. An outstanding example of the latter type was the mare, Hanover Maid. During training, she always refused to exert herself. She slowed down when she began to tire, and appeared to lack fighting spirit. But in a race she would run her heart out. Between heats, she was always the calmest horse in the paddock, resting her head on the guy lines, closing her eyes, and relaxing.

AT THE end of a race, the horses are given a salt bath, scraped off, rubbed down with liniment to prevent stiffness, and then walked around for an hour or more after which they are permitted to nibble grass for thirty minutes or so before going in for the evening ration of grain, mash, and hay.

Many racing horses are sent south during the winter for additional training. The most famous of the winter camps is the Seminole Driving Park, thirteen miles from Orlando, Fla. As many as 100 noted pacers and trotters winter there so they can keep in training all the year around.

The story of harness-horse racing in America runs back nearly 150 years. Messenger, a gray English thoroughbred, was imported to Long Island and

bred to Dutch mares in the year 1788. He lived to be twenty-eight years old, and so great was the esteem in which he was held by horse lovers that a volley of musketry was fired over his grave when he died. One of his descendants was Hambletonian, the stallion whose blood is said to run in the veins of ninety per cent of the modern trotters, and for whom the annual classic at Goshen, N.Y., is named.

In 1818, the first official trotting record for the mile was established by Boston Blue at Jamaica, N.Y. This horse covered the distance in three minutes. Thirty years later, trotters had clipped half a minute from the mark and by 1891, Sunol was making the mile in 2:08 1/4. The following year, the bicycle sulky was introduced, and Nancy Hanks cut a full four seconds from the record. The two-minute horse arrived in 1903. The world's record now stands at 1:56 1/4. It was made at Lexington, Ky., in 1922, by the unbeatable Peter Manning. This great horse still holds fifteen state records and, in addition, the world's mark for two miles as well as the record for the mile.

IN SPITE of the spectacular performances of Peter Manning in the 1920's, interest in harness-horse racing slumped. Competition from airports and motor-dromes was too great. Now, the country is being swept by a revival of interest in this sport developed by scientific breeding and training.

Put Your Garden in the Test Tube

(Continued from page 71)

port fish life, but not as well as water that is very slightly acid.

Phosphorus contributes to the fertility of soil, in the form of phosphates of calcium, magnesium, and iron. You can test earth from your garden for the presence of phosphorus with an easily prepared reagent. Dissolve about two and a half grams of ammonium molybdate crystals in twenty-five cubic centimeters (about seven teaspoonfuls) of distilled water, using heat to hasten solution. Filter the resulting liquid, if it is turbid. Then pour it into twenty-five cubic centimeters of pure, strong nitric acid. Finally add fifty cubic centimeters more of distilled water. Keep the solution in a glass-stoppered bottle.

TO TEST soil for phosphorus, place about a half teaspoonful of the earth in a test tube and add water to make a total volume of about thirteen cubic centimeters. Now add one drop of "one-to-three" acetic acid (one part of strong or "glacial" acetic acid to three parts of water). Shake the contents of the test tube for half a minute, and filter. To one cubic centimeter of the filtrate, or liquid that passes through the filter, add a piece of clean sheet or lump tin (not "tin" foil from a candy bar, which is actually aluminum) and five cubic centimeters of your ammonium molybdate test solution. If a blue color appears—a reaction requiring about half a minute—then the soil contains the needed element phos-

phorus. The depth of the shade of blue indicates the amount of phosphorus present.

Plants require nitrogen, too, and get it from nitrate compounds in the soil. You can make a nitrate test solution by dissolving three one-hundredths of a gram of an organic chemical known as diphenylamine in twenty-five cubic centimeters of strong, chemically pure sulphuric acid. Keep this strongly corrosive liquid in a glass-stoppered bottle. If its color changes in time to blue, brown, or pink, it is worthless for your purpose and a new batch must be made up.

To test soil for nitrates, follow the same preliminary procedure as in testing for phosphorus. That is, place half a teaspoonful of the soil in a test tube, fill with distilled water to a volume of thirteen cubic centimeters, add a drop of one-to-three acetic acid, shake for half a minute, and filter. Now place one drop of the filtrate on a glazed white porcelain plate and add six drops of the diphenylamine test solution. A blue color develops if nitrates are present.

POTASSIUM, or "potash," in various forms of chemical combination, also serves as a valuable plant food in the soil. Solutions containing potassium give a yellow precipitate when treated with a reagent known as sodium cobaltinitrite. To prepare this, mix two cubic centimeters of a ten-percent solution of sodium nitrite (Continued on page 125)

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Put Your Garden in the Test Tube

(Continued from page 124)

(not nitrate), five or six drops of a dilute (say, ten-percent) solution of cobalt nitrate, and one cubic centimeter of strong (glacial) acetic acid.

With this reagent, you can show that a fertilizer rich in potassium, such as potassium chloride or potassium carbonate, can be applied to the soil with the assurance that little of the compound will be carried away by drainage or excessive rainfall. Dissolve about a gram of either of these potassium chemicals in a liter (roughly a quart) of water, and let the solution seep through ordinary garden soil in a vertical glass tube of about one-inch diameter. The liquid may be admitted a little at a time through a "choked-stem funnel," made by plugging an ordinary glass funnel with a short strip of rubber tubing and using a pointed glass rod as a stopper. The bottom of the one-inch tube contains a wad of absorbent cotton that holds in the soil and allows the solution to filter through. Test the liquid that has passed through the soil with your sodium cobaltinitrite reagent. You will observe little or no yellow precipitate, while the original solution gives a conspicuous amount, showing that the soil effectively absorbs the potassium.

ANTS can be a nuisance both in the garden and in the home. You can make a good ant trap by first dissolving about three quarters of an ounce of ordinary washing soda, and then about an ounce of arsenious oxide (called also white arsenic), in a quart of water. This makes a solution of sodium arsenite. Since it is poisonous, do not use any household utensil in making it up, but employ a tin can that can be thrown away afterward. Mix one fluid ounce of your solution with about a pint of honey or molasses, to serve as bait for the ants. Pour the mixture over pieces of wrapping tissue, or excelsior, resting in old preserve-jar lids, and place the traps about the garden and the house.

Incidentally, you can readily destroy silverfish, the insect pests that play havoc with books by eating the pages and the binding with the same sodium arsenite solution. Instead of mixing the liquid with honey or molasses, however, combine it with starch or flour to form a paste, and smear the mixture in old bottle caps, where it will harden. Place these little poisonous disks about the house wherever the insects are found—but be sure to keep them safely out of reach of children, remembering especially that a crawling baby delights in putting every conceivable object in its mouth. The poisonous ant traps, of course, should be hidden or safeguarded.

Tamed Emus May Provide Meat and Eggs in Russia

ROAST "chickens" as big as good-sized calves, and breakfast eggs five or six inches long may grace Soviet tables, if experiments in domesticating the emu prove successful in practice. The giant, ostrich-like Australian birds are said to be adapted to domestication in the Russian climate, and to provide quantities of meat and eggs more cheaply than chickens, ducks, and other fowl.

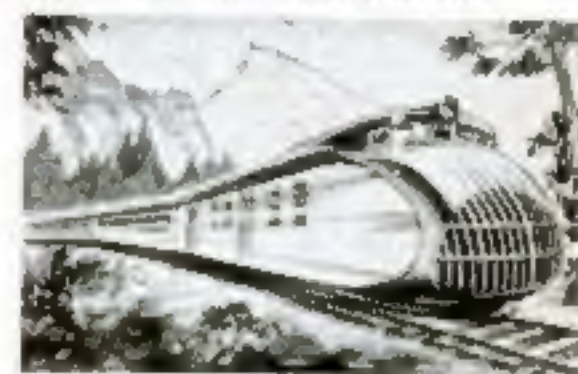
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The Marvels of Underground Oil Railroads

(Continued from page 21)

cables lashed to the trunks of cypress trees. And welders, sparks streaming from their torches like fireworks, had to stand on logs to get a solid footing. A few months later, gangs of workmen putting in a 250-mile line through northern Michigan, were battling zero winds and five-foot snow drifts.

A pipe-line crew consists of about forty men under a "laying boss." Many of the laborers are skilled in some particular part of the work. There are, for example, "jack men," "bar men," "rope men," and "tongs men," each expert in the use of certain tools or apparatus. The diameter of the steel tubes employed on pipe lines runs from two inches to nearly eight feet. The largest, employed on a western water conduit, required 450 pounds of metal to weld a single joint.

Recently, a number of innovations have aided in the construction and operation of pipe lines. Multiflame welding torches that preheat the metal when pipes are joined together, speed up the work. In Texas and Louisiana, thin-walled steel tubes, called "stovepipes," are being widely used for sending oil under low pressure from wells to refineries. By the use of a "grasshopper," a holding device which keeps the sections in line while men weld them together, such lines can be laid rapidly. Another innovation is an automatic pipe-line pump, controlled electrically and cooled by the oil which flows around the cylinders of the engine in passing through the station.

High-speed machinery of many kinds now clips days from construction time. Motor-driven ditchers scoop out miles of trenches in a day. Tractors, equipped with special cranes, drag into place sections of pipe as long as a city block. One machine coats the pipe with corrosion-proof paint or enamel and another fills in the trench and covers the pipe.

As different sections of the line are completed, they are tested for leaks. Compressed air and soap suds are sometimes employed in the test. Regular pressures up to 600 pounds to the square inch are maintained during the pumping of oil. A final check is made by one concern in the form of a forty-hour hydrostatic test in which the pipes are filled with water and the pressure raised to 1,200 pounds to the square inch. All during this experiment, engineers watch sensitive gauges, alert for any drop in pressure that would indicate a leak.

NOT long ago, while testing a new gasoline line in this way, they saw the gauge needle suddenly swing back around the dial. A big break had occurred somewhere. They soon found where. A geyser of water was shooting up from the middle of a farmer's field. Eighty acres were flooded before they could turn the water off. Then, company officials discovered what had happened. The farmer had drilled a hole in the line and attached a small pipe for his private use. However, he had neglected to reinforce the line at the spot, and the pressure had blown out his attachment and flooded the field.

In some sections of the country, pipe-line tapping has developed into a major racket. On one ten-mile stretch in Kan-



In their course across the country, long-distance pipe lines climb mountains and dive under rivers. Here sections are being laid through the bed of a small stream

sas, gasoline robbers broke into a line eight times in fourteen months. In another instance, 1,000,000 gallons of gasoline—enough to fill a train of 100 tank cars—vanished while in transit through Oklahoma lines.

Swift airplanes, carrying observers who peer through powerful binoculars, now cruise back and forth over one pipe line as an aid to detecting leaks and catching crooks. Line walkers, who do nothing but trudge along the pipe-line right of way on the alert for patches of dead grass, are also on the pay roll of most concerns. When gasoline or oil leaks into the ground, it kills the grass above it. In California, tiny leaks that were hardly visible on the pipe have been discovered through small brown spots in the midst of green vegetation. Where there is no grass, line walkers stoop from time to time and gather up handfuls of sand which they sniff for telltale fumes.

Should a drop in pressure show that the line has been tapped, an ingenious electrical "divining rod" now aids in quick discovery of the buried pipe which is diverting the flow. This radio detector is somewhat similar to the apparatus used by up-to-date prospectors in discovering the whereabouts of buried metal. It consists of two parts; one a set of headphones and a sensitive electric meter, the other an induction coil, an electric generator, and a rod-shaped electrode implanted in the ground. The latter sends electric pulsations along a 1,500-foot section of the line.

Wearing the earphones and carrying the electric meter, one of the com-

pany engineers walks along above the pipe. The device is so tuned that it is unaffected by the line current. But any other metal below ground unbalances the delicate tuning and produces a hum in the earphones. The expert instantly glances at the needle on the meter. If the buried metal consists of only small objects or tin cans, the needle hardly moves. But if it is a big object like a tap pipe, it jumps across the dial.

SOON after oil began flowing through pipe lines, trouble was experienced with a paraffinlike residue which began to clog up the tubes. Chemical solutions failed to eat it away. Hard balls of wood, pumped through the pipes in an effort to clear them, wore out from friction before they scraped away the residue. Finally, an arrangement of leather and sheet-iron washers strung on a bolt proved successful. It was named the "go-devil," from the rumbling, grinding noise it made underground as it traveled through the pipes.

Present-day go-devils are elaborate mechanisms nearly three feet long. They have whirling scrapers, wheels like cowboys' spurs, and, sometimes, steel brushes that polish the interior of the pipes as the mechanism is pushed along by the pressure of the fluid.

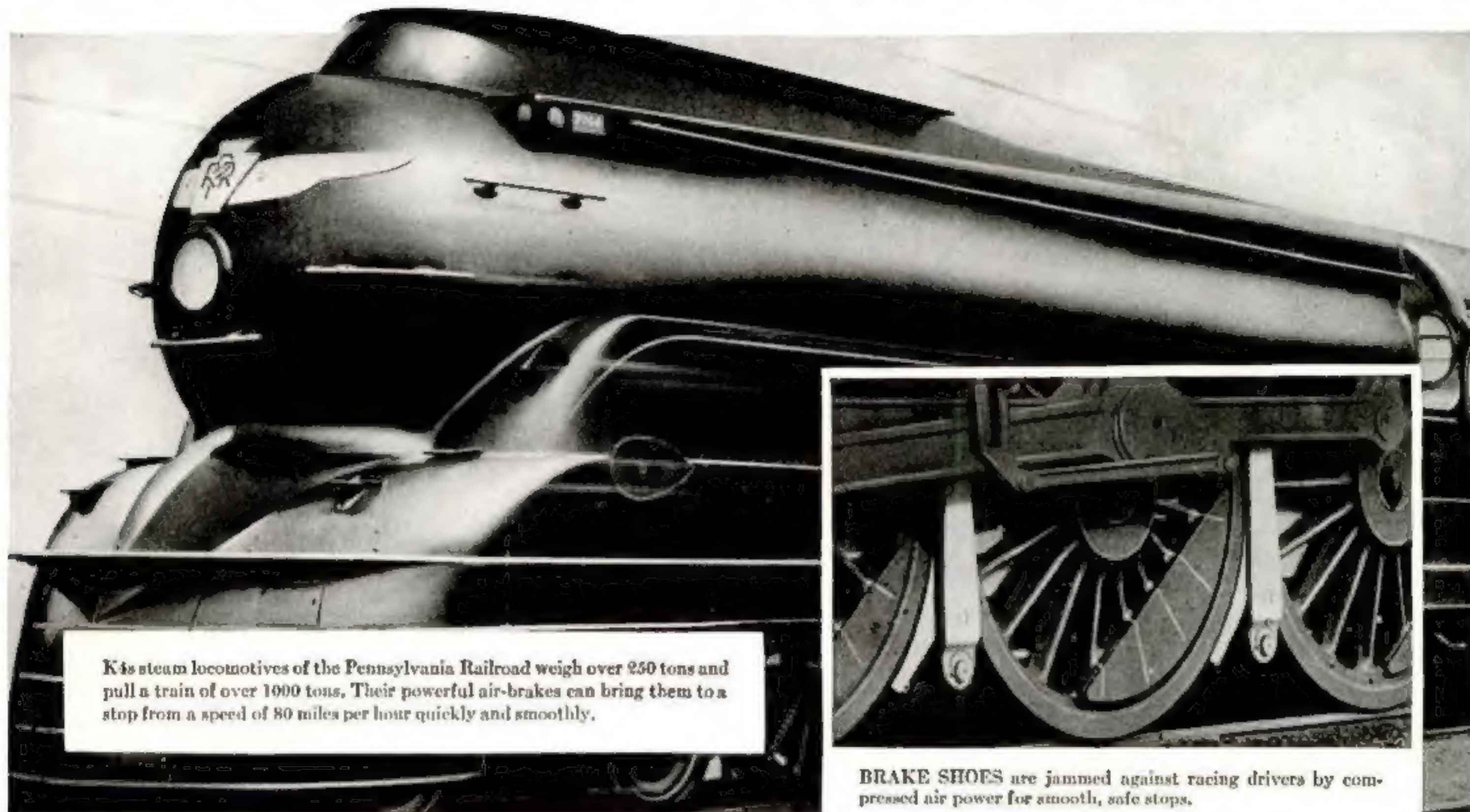
One of the biggest go-devil cleaning jobs on record was completed recently in Pennsylvania. A line carrying gasoline from Marcus Hook, Pa., to Pittsburgh, Pa., had been in operation five years. Its original capacity of 15,000 barrels a day had dropped to 12,000 barrels as a result of accumulated iron oxide deposits within the pipes. This meant a loss of twenty percent in revenues, and the company decided to clean out the 306 miles of piping.

Ground crews, carrying two-way radio sets, followed the go-devils by the rumbling audible above-ground as they moved along at from two to three miles an hour. If the noise stopped, it meant the mechanism was stuck and bumper go-devils were sent through the line to push it ahead. If this failed, emergency crews, summoned by radio, rushed to the spot, cut open the line with acetylene torches, removed the go-devil, cleaned out the accumulated deposits, replaced the mechanism, and sealed up the pipe again. Ten times, the line had to be cut open before the work was completed.

Besides bringing out wagon loads of iron oxide deposits, the go-devils pushed several surprises from the end of the pipe. There were parts of tools, large stones, welding icicles, and even a ten-foot length of two-by-four lumber. Most of these objects evidently found their way into the line during construction.

Although the man in the street hears little about them, American pipe lines are valued at close to \$10,000,000,000. Veritable rivers, formed of many kinds of fluid, rush through the subterranean channels. The longest and most elaborate of these underground freight lines are the conveyors of petroleum and its products. In sixty-five years, oil pipe lines have expanded from a single 1,000-foot section of two-inch tubing into a leading form of transportation.

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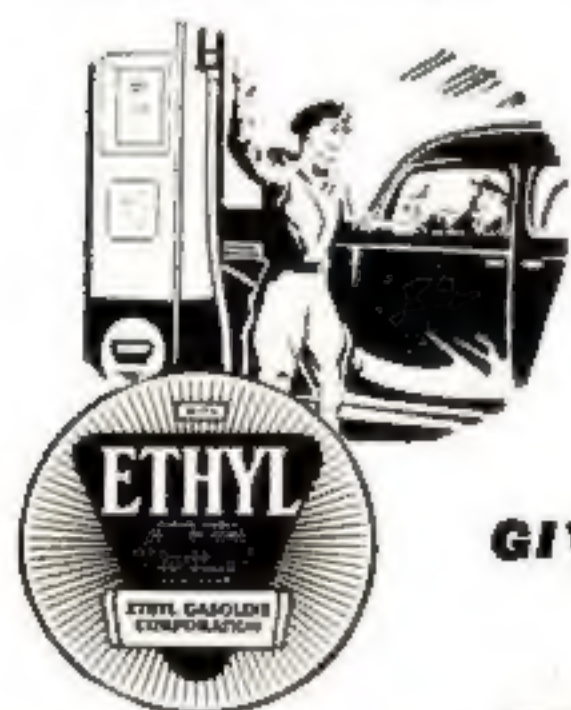
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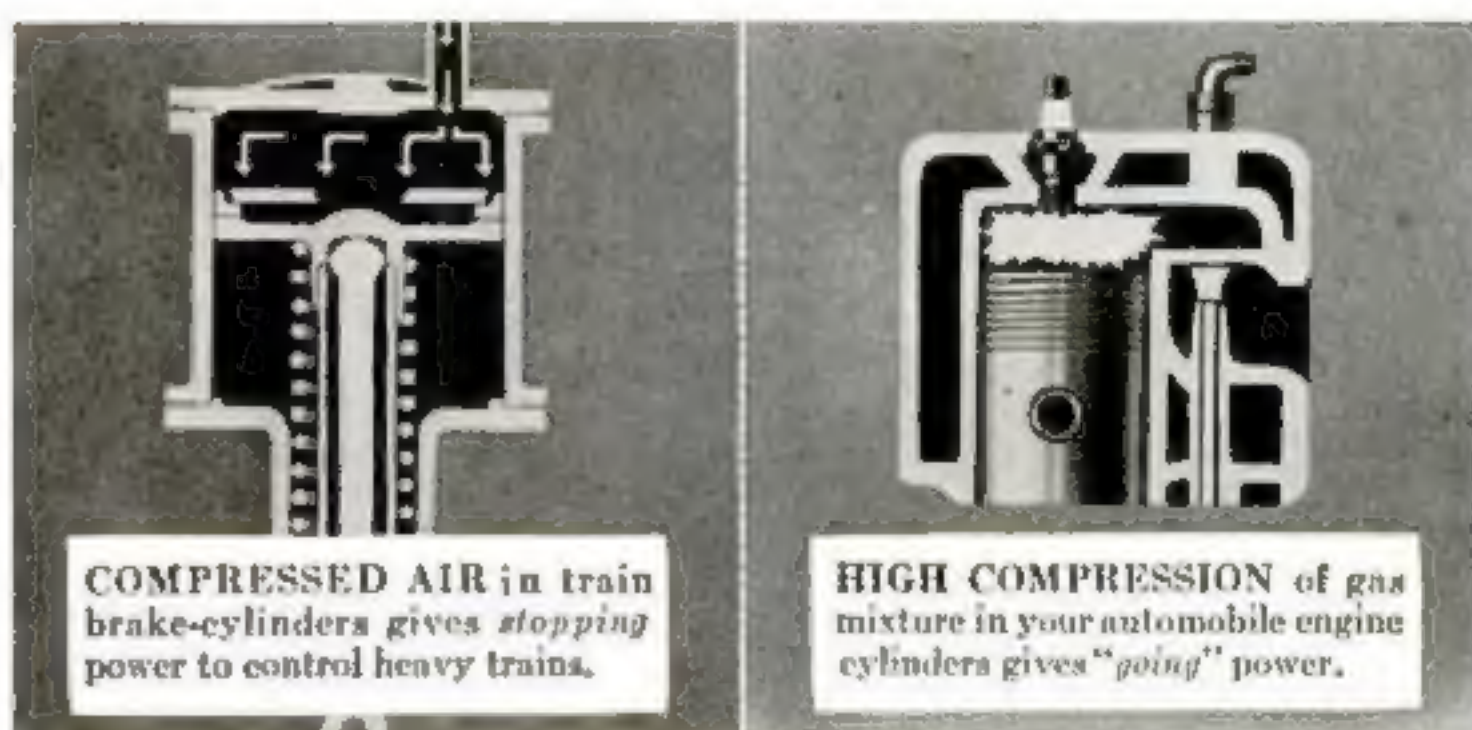
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